SOUTHWEST RESEARCH INSTITUTE™
6220 Culebra Road Post Office Drawer 28510
San Antonio, Texas 78228-0510

AUTOMOTIVE PRODUCTS AND EMISSIONS RESEARCH DIVISION

Fleet Test Evaluation of Fuel Additive Performance on Emissions

FINAL REPORT

SwRI Project 08-03481

Prepared for

Infineum USA LP
Linden, NJ

July, 2000
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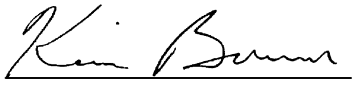

Kevin Brunner
Manager
Fuels Technology and Product
Development Section

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I. INTRODUCTION

Southwest Research Institute (SwRI) conducted a fleet test program to investigate the performance of a fuel additive in relation to vehicle emissions for Infineum USA LP. A total of 28 vehicles were completed in this program with emission test sequences on each vehicle at each of two accumulation intervals. Vehicles representing a variety of the most popular models in today's vehicle fleet were operated on mileage accumulation dynamometers (MADs).

II. PROGRAM OUTLINE

The test fleet included seven vehicle model groups with four vehicles in each group. Two 8,000-mile test sequences were conducted on each test vehicle. Before the evaluations began, each test vehicle underwent a qualification check, which included a 1,000-mile oil consumption determination followed by an initial 3-bag Federal Test Procedure (FTP) emissions measurement. Vehicles that passed the oil consumption and emissions check, underwent the following test sequences:

SOT Sequence:
- Duplicate (or triplicate when required) emissions test sequences

RUN1 sequence:
- Fuel charge
- Accumulation of 4,000 miles on MAD
- Oil change
- Accumulation of 4,000 miles on MAD
- Oil change
- Duplicate (or triplicate when required) emissions test sequences

RUN2 sequence:
- Fuel charge
- Accumulation of 4,000 miles on MAD
- Oil change
- Accumulation of 4,000 miles on MAD
- Oil change
- Duplicate (or triplicate when required) emissions test sequences

A detailed test procedure follows.

A. TEST MATRIX

The test design included vehicle evaluations on two fuels, a Reference Fuel and a Test Fuel. The two fuels used an identical base fuel, with each containing a different fuel additive. Test vehicles in each group were coded 1 through 4; for example, four Ford Explorer vehicles were coded EX1 through EX4 and evaluated according to the following matrix:

Table 1. Test Fuel and Vehicle Matrix

Vehicle Code	RUN1	RUN2
1	Reference fuel	Test fuel
2	Test fuel	Reference fuel
3	Reference fuel	Alternating fuels
4	Alternating fuels	Reference fuel

Alternating fuels is defined as switching between the Reference Fuel and the Test Fuel at each fueling point as described in the Test Fuel section.

B. TEST VEHICLES

Seven vehicle groups covering a number of the most popular vehicle models in today's vehicle fleet were evaluated in this program. Each group contained four vehicles for a total fleet of 28. The vehicles were selected to include a variety of engine types, model years (at least one vehicle group from each of the last 6 years), and emissions certifications. Detailed test vehicle information is listed in Table 2. All test vehicles were either purchased or leased.

C. VEHICLE QUALIFICATION CHECK

After vehicle acquisition, an initial oil and filter change was performed to determine the weight of the oil added to the crankcase. The vehicle was then driven 1,000 miles on public roadways using the Reference Fuel. The oil was drained and the used filter removed to determine oil consumption by weight. The oil consumption limit was measured by SwRI's Standard Oil and Filter Changing and Weighing Procedure. Detailed information of initial oil consumption results on each vehicle is listed in Appendix A.

Vehicles that passed the initial oil consumption check were then tested for regulated emissions according to the FTP 3-bag test cycle using Reference Fuel. The criterion for the initial emissions levels check was to be less than 125% of the emission standard to which the vehicles were certified.

D. TEST FUEL

Infineum provided approximately 30,000 gallons of unadditized base fuel and two fuel additives, coded Vektron® 2864 and Vektron® 6913. The unadditized base fuel, coded GA-3931 by SwRI, had been selected to approximate the physical and chemical specifications of a California reformulated Phase 2 gasoline without oxygenate. The fuel analysis results of the base fuel are listed in Appendix B.

SwRI blended the base fuel with Vektron® 2864 and Vektron® 6913 to form "Reference Fuel" and "Test Fuel", respectively. Infineum provided fuel blend instructions as shown in Table 3.

Table 3. Fuel Blend Instructions

Fuel Code	SwRI Fuel Code	Treat Rate
Reference Fuel	GB-3949 (GREEN fuel)	Unadditized base fuel with Vektron 2864 at 154 PTB
Test Fuel	GB-3942 (RED fuel)	Unadditized base fuel with Vektron 6913 at 234 PTB

Table 2. TEST VEHICLE INFORMATION

Vehicle Code	Year	Make/Model	Engine Size	Certification*	Engine Family No.	Vehicle Identification Number	Initial Mileage
EX1	1999	FORD EXPLORER	4.0L V-6	LEV LDT	XFMXT04.02GC	1FMZU32X5XZB67396	22,700
EX2	1999	FORD EXPLORER	4.0L V-6	LEV LDT	XFMXT04.02GC	1FMZU32X7XZB34402	24,189
EX3	1999	FORD EXPLORER	4.0L V-6	LEV LDT	XFMXT04.02GC	1FMZU32X2XZB34405	21,066
EX4	1999	FORD EXPLORER	4.0L V-6	LEV LDT	XFMXT04.02GC	1FMZU32X0XZB38694	24,189
GC1	1999	CHEVROLET C1500	5.7L V-8	LDT	XGNXTO5.7181	1GCEC19R7XR113020	24,575
GC2	1999	CHEVROLET C1500	5.7L V-8	LDT	XGNXTO5.7181	1GCEC19R3XR109014	57,210
GC3	1999	CHEVROLET C1500	5.7L V-8	LDT	XGNXTO5.7181	1GCEC19R9XR129557	25,795
GC4	1999	CHEVROLET C1500	5.7L V-8	LDT	XGNXTO5.7181	1GCEC19R7XR131376	33,280
HA1	1998	HONDA ACCORD	2.3L I-4	LEV LDV	WHNXVO2.3PA3	1HGCG5648WA224640	29,529
HA2	1998	HONDA ACCORD	2.3L I-4	LEV LDV	WHNXVO2.3PA3	1HGCG5644WA174738	25,909
HA3	1998	HONDA ACCORD	2.3L I-4	LEV LDV	WHNXVO2.3PA3	1HGCG5643WA170079	18,074
HA4	1998	HONDA ACCORD	2.3L I-4	LEV LDV	WHNXVO2.3PA3	1HGCG560WA229024	26,087
FF1	1997	FORD F-150 TRUCK	4.6L V-8	LDT	VFM4.6BGKEK2T	1FTDX1766VKB19406	39,758
FF2	1997	FORD F-150 TRUCK	4.6L V-8	LDT	VFM4.6BGKEK2T	1FTDX1763VKD29753	42,179
FF3	1997	FORD F-150 TRUCK	4.6L V-8	LDT	VFM4.6BGKEK2T	1FTDX176XVNA09764	60,513
FF4	1997	FORD F-150 TRUCK	4.6L V-8	LDT	VFM4.6BGKEK2T	1FTDX1768VNA03459	53,798
FE1	1996	FORD ESCORT	1.9L I-4	LDV	TFM1.9V8GKEK	1FASP15S2TW122149	64,303
FE2	1996	FORD ESCORT	1.9L I-4	LDV	TFM1.9V8GKEK	1FASP15J9TW120768	72,250
FE3**	1996	FORD ESCORT	1.9L I-4	LDV	TFM1.9V8GKEK	1FASP14J0TW157791	63,783
FE4	1996	FORD ESCORT	1.9L I-4	LDV	TFM1.9V8GKEK	1FASP15J5TW112747	79,225
FE5**	1996	FORD ESCORT	1.9L I-4	LDV	TFM1.9V8GKEK	1FASP11J5TR129623	70,720

DC1	1995	DODGE CARAVAN	3.3L V-6	LDT	SCR3.328GFEA	2B4GH55R2SR212917	75,214
DC2	1995	DODGE CARAVAN	3.3L V-6	LDT	SCR3.328GFEA	1B4GH54R3SX506992	96,790
DC3	1995	DODGE CARAVAN	3.3L V-6	LDT	SCR3.328GFEA	2B4GH4R35R326421	105,646
DC4	1995	DODGE CARAVAN	3.3L V-6	LDT	SCR3.328GFEA	1B4GH44R0SX509424	81,194
GP1	1994	BUICK LESABRE	3.8L V-6	LDV	RIG3.8V8GFEA	1G4HP52L3RH492777	88,162
GP2	1994	BUICK LESABRE	3.8L V-6	LDV	RIG3.8V8GFEA	1G4HP52L9RH423110	47,220
GP3	1994	BUICK LESABRE	3.8L V-6	LDV	RIG3.8V8GFEA	1G4HP52L5RH420057	62,589
GP4	1994	OLDSMOBILE 88	3.8L V-6	LDV	RIG3.8V8GFEA	1G3HY522BRH320259	66,450

* LEV: Low Emission Vehicle
LDT: Light Duty Truck
LDV: Light Duty Vehicle

** Due to mechanical problem, FE3 was dropped from the test fleet and replaced with FE5.

Initially, 550 gallons of Reference Fuel were blended to conduct the vehicle qualification checks. A single batch of 15,600 gallons of Reference Fuel was blended and stored in an above-ground fuel tank with a nitrogen blanket for minimal ambient exposure. As the Reference Fuel was depleted, another 2,000 gallons were blended and put into the same above-ground fuel tank. A single 9,800-gallon batch of Test Fuel was also blended and stored in a single above-ground fuel tank with a nitrogen blanket. No additional Test Fuel was blended in this program. Both Reference Fuel and Test Fuel samples were analyzed after blending, and the results are listed in Appendix B.

The first fill-up for all test vehicles assigned to the alternating fuel sequence was Reference Fuel or GREEN fuel. Following mileage accumulation, each vehicle's tank was topped off with the assigned fuel prior to the oil change and emission tests. All test vehicles following the alternating fuel sequence were filled with the Test Fuel or RED fuel before oil change and emissions tests. A fuel sample was taken from each vehicle after the final fill-up.

E. TEST OIL

All vehicles used the same batch of API SJ and ILSAC GF2 classified Pennzoil 5W-30 motor oil in this program. Engine oil changes were performed upon acquisition, after the 1,000-mile initial mileage accumulation, and at the mid-point and end of every run. Oil changes at the beginning and end of each 8,000-mile run were performed before the emissions evaluations. The oil level of each vehicle was checked daily. Oil was weighed and added if the level was below one quart. Appendix A lists oil consumption and oil add information of each test vehicle.

F. MILEAGE ACCUMULATION

Twelve fully automated MADs were used in this program. The MADs are capable of controlling critical engine parameters to match on-road conditions. SwRI used an EPA-provided cycle for operating the vehicles on the MADs. The mileage accumulation cycle was performed according to 40 CFR Ch. 1 (7-1-94 Edition) § 86.084-26 and as modified in the Mobile Source Air Pollution Control (MSAPC) Advisory Circular A/C No. 37-A to include a driving mode of 70 mph top speed. Each vehicle was run 16 hours per day with an 8-hour soak time.

The MAD utilizes an electric motor and clutch to provide motoring capability and inertia simulation. A power absorption unit provides braking and speed control. The vehicle's driven wheels provide power to the unit through a 48-inch diameter single-roll. Some of this power was used to produce wind speed proportional to the roll speed by means of a 60,000-cfm blower. This setup reproduced the underhood and underbody temperatures experienced by the engine and exhaust emission systems under normal on-road driving conditions. The vehicle loading was maintained by the MAD control system using a throttle positioner attached to the vehicle's accelerator pedal. Figure 1 presents the MAD unit diagram.

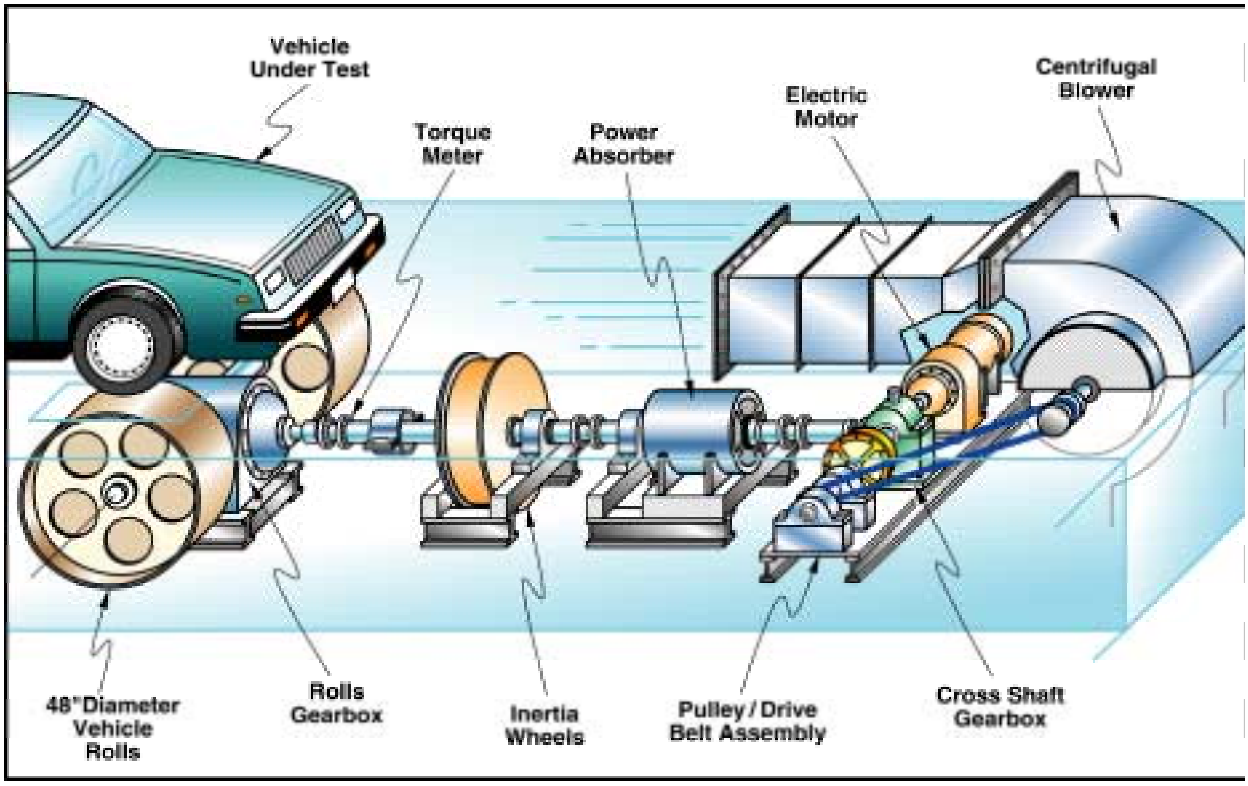

Figure 1. MAD Unit Diagram

G. EMISSIONS TESTING

Each vehicle was emissions tested in duplicate over a sequence of test cycles that included the FTP, the US06, and the Highway Fuel Economy Test (HFET) at three different times during this program. Triplicate test sequences were run when repeatability criteria were not met for the FTP data (as judged using the CRC Auto/Oil Protocol; if higher emission value divided by lower emission value is >1.33 for THC, >1.70 for CO, or >1.29 for NOx, run a third test sequence). If these repeatability criteria were met for the FTP, but not for the HFET, then only an additional HFET was run following the scheduled test sequence. No repeatability criteria were applied to the US06 data. The test sequence for each vehicle/fuel/test interval combination is presented in Table 4. Emissions tests were performed at the following times during the program.

- Base (Start of test)
- RUN1 (End of RUN1 mileage accumulation)
- RUN2 (End of RUN2 mileage accumulation)

All vehicles were tested using a Horiba light-duty 48-inch diameter single-roll chassis dynamometer. This dynamometer electrically simulates inertia weights up to 12,000 lbs. over the FTP-75 and provides programmable road load simulation of up to 125 hp continuous at 65 mph (300 hp momentary duty at 65 mph). SwRI utilized EPA supplied dynamometer settings and the Mears model to determine appropriate settings for the chassis dynamometer.

The FTP driving cycle used in this program consists of a cold-start 505-second transient phase followed immediately by an 867-second stabilized phase. Following the 867 phase, the vehicle is allowed to soak for 10 minutes with the engine turned off before proceeding with a hot-start 505 phase to complete the test. A speed versus time illustration of the divided 505 and the 867 phases of the FTP driving cycle is given in Figure 2. The US06 followed the FTP cycle in the test sequence. This cycle is 600 seconds in duration with an average speed of 48 mph, a maximum speed in excess of 80 mph, and a total distance of 8 miles. Figure 3 shows the vehicle speed versus time for the US06 driving cycle. The HFET was conducted after the US06. The HFET has an average speed of 48.2 mph, a maximum speed of 59.0 mph, and a total distance of 10.2 miles. A typical HFET begins by driving the vehicle over the HFET cycle to prepare or condition the vehicle for the actual test. When the first conditioning cycle is complete, sampling begins immediately with the start of the second cycle. Figure 4 presents the HFET driving cycle.

Table 4. EMISSION TEST SEQUENCE

1. Upon receipt of vehicle, operate over the FTP-75, US06, and HFET cycles as a prep sequence. Do not record emissions. Soak vehicle overnight.

2. Next day conduct cold-start FTP-75 followed by US06 and HFET on tank fuel. Record NMHC, CO, NO_x, and fuel economy as determined by carbon balance for each test cycle. Soak vehicle overnight.

3. Next day conduct cold-start FTP-75 followed by US06 and HFET on tank fuel. Record NMHC, CO, NO_x, and fuel economy as determined by carbon balance for each test cycle. If emissions do not pass Auto/Oil criteria for the FTP-75, continue to Step 4. If emissions pass the Auto/Oil criteria for the FTP-75, but not for the HFET, run an additional HFET cycle and proceed to Step 6. If both the FTP-75 and HFET meet Auto/Oil criteria proceed to Step 6.

4. Soak vehicle overnight.

5. Next day conduct cold-start FTP-75 followed by US06 and HFET. Record NMHC, CO, NO_x, and fuel economy as determined by carbon balance for each test cycle.

6. Return vehicle for mileage accumulation or for end of test.

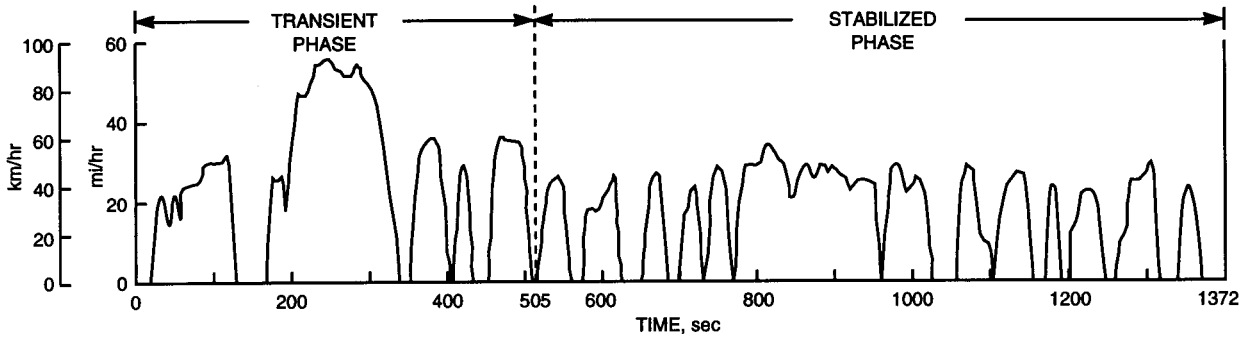

Figure 2. Speed Versus Time Illustration of 505 and 867 Phases of FTP Driving Cycle

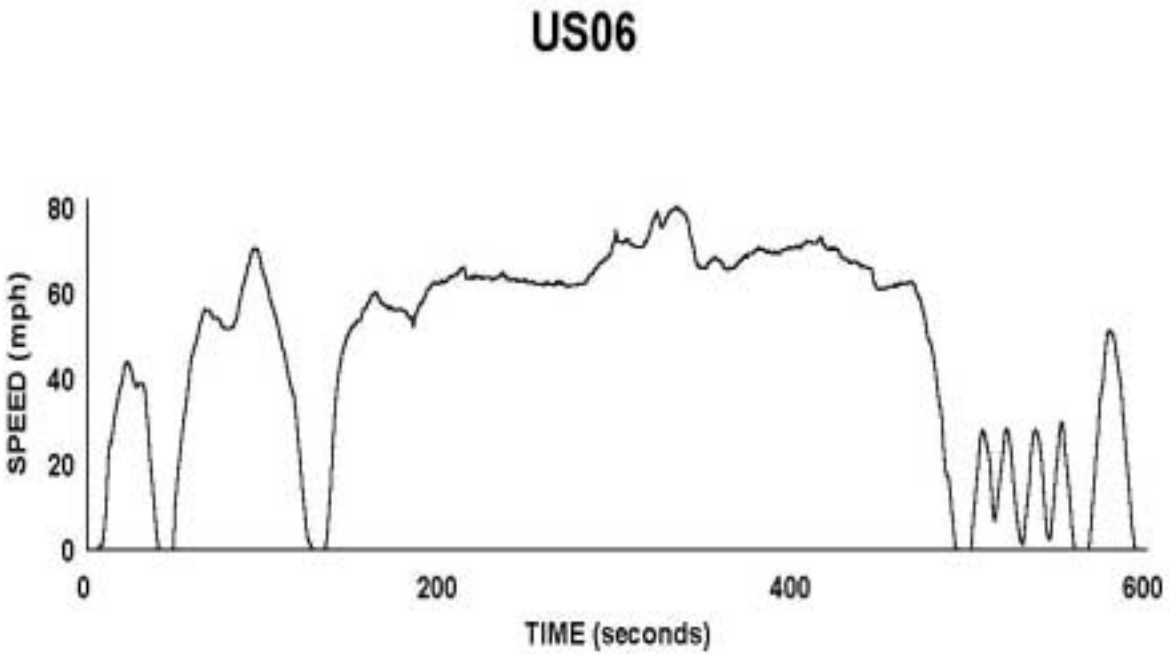

Figure 3. US06 Driving Cycle

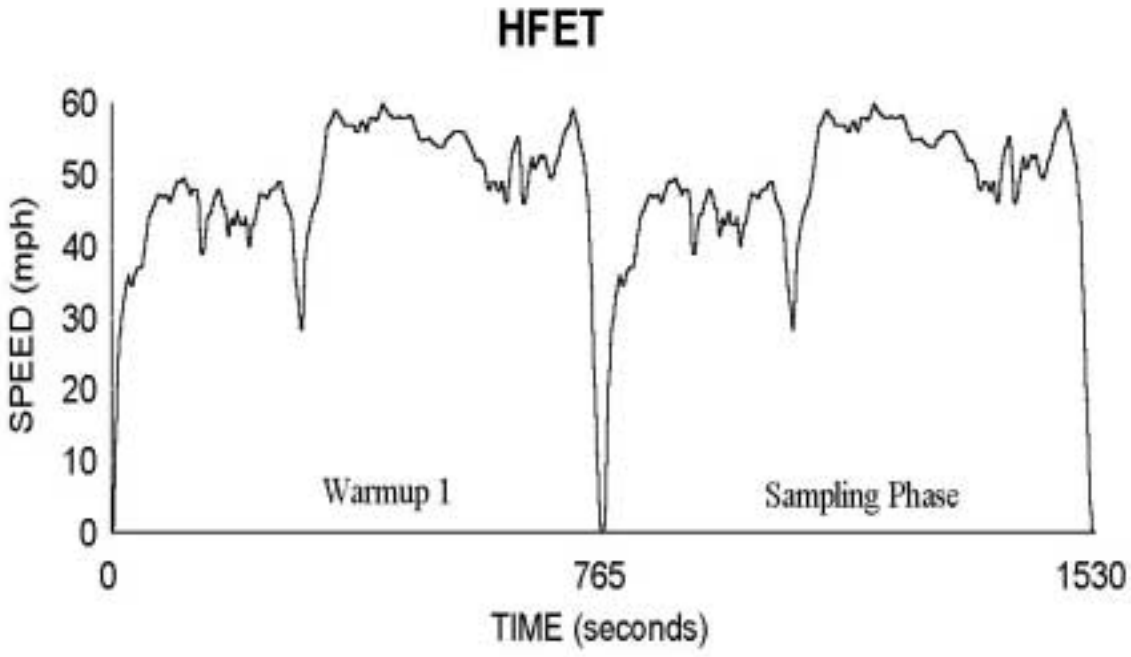

Figure 4. HFET Driving Cycle

III. PROGRAM OPERATION

A. TEST VEHICLES AND INITIAL QUALIFICATION CHECK

The initial program setup required all test vehicles to have a minimum odometer reading of 15,000 miles and a maximum of 75,000 miles. Due to difficulty in finding older model vehicles within the mileage limit, four Dodge Caravans, one Ford Escort, and one Buick LeSabre had initial mileages over 75,000 miles. Infineum allowed SwRI to accept these vehicles after they passed the initial oil consumption and emissions check. Infineum also allowed a 1994 model Oldsmobile 88 vehicle to be accepted in the 1994 model Buick LeSabre vehicle group because all shared an identical GM 3.8L V-6 engine. All test vehicles were initially checked for mechanical problems and engine computer error codes before conducting the vehicle qualification check.

Initially, the oil consumption limit was set at 150 ml. The limit was later re-set to 200 ml by Infineum. Due to difficulty in finding 1994 and 1995 model test vehicles with less than 200 ml oil consumption, Infineum revised the limit to 250 ml and later further extended the limit for these vehicles. The oil consumption surpassed the 250 ml oil consumption limit on two 1994 Buick LeSabres (GP1 and GP3) and one 1995 Dodge Caravan (DC2). A total of eight vehicles were rejected that failed the oil consumption check. The rejected vehicles included two 1999 Chevrolet C1500 trucks, one 1997 F-150 truck, one 1996 Ford Escort, two 1995 Dodge Caravans, and one 1994 Buick LeSabre. No test vehicle failed the initial emissions test after passing the oil consumption check.

B. MAD VEHICLE OPERATION PARAMETERS

MAD operation requires a two-parameter road load force equation (F0 and F2) according to the technique of White and Korst (SAE Paper 720099) to calculate the instantaneous road load force for each vehicle model. SwRI followed EPA-recognized least square methods for developing “a”, “b”, and “c” coefficients for the Mears Model to calculate a three-parameter road load force equation. This model requires coastdown data from drive and non-drive axles and incorporates these frictional measurements with windage and aerodynamic resistance projections to yield dyno coefficients. Triplicate 65 to 15 mph coastdowns were conducted on each axle, and the average results were used as input for the Mears Model.

SwRI converted the coefficients “a”, “b”, and “c” obtained from Mears Model to F0 and F2 coefficients by forcing F1 to zero and using the Levenberg-Marquardt method to solve for F0 and F2. Vehicle weights were determined by direct measurement before vehicle operation began on the MAD. Table 5 lists the F0 and F2 coefficients and the weight of each vehicle model.

Table 5. MAD Vehicle Operation Parameters

Vehicle Model	F0, lbf	F2, lbf/Mph^2	Vehicle Weight, lbs
Ford Explorer	34.247	0.038	3945
Chevrolet C1500	35.725	0.042	4651
Honda Accord	33.786	0.024	3082
Ford F-150 Truck	30.213	0.042	4369
Ford Escort	29.120	0.021	2479
Dodge Caravan	45.195	0.029	3675
Buick LeSabre	47.799	0.027	3380

C. MAD OPERATION

Up to 12 MADs were used for mileage accumulation. Test vehicles were rotated among the available MAD units at times when more than 12 test vehicles were assigned mileage accumulation. Detailed log reports were obtained for mileage accumulation, vehicle rotation, fuel verification, changing of fuels, monitoring operation, and reporting problems.

To ensure fueling accuracy, the Reference Fuel and the Test Fuel were color coded as GREEN fuel and RED fuel, respectively. Two trailered fuel tanks with fuel pumps were dedicated to transfer the fuels from the storage tanks to the MAD to fuel the vehicles. Each fuel tank was color-coded and matched the fuel color code. The test fuel code and its color code were also displayed on each test vehicle. Fuel transfers from the storage tanks to the trailered fuel tanks were recorded for each transaction.

Fuel adds were performed when the vehicle's fuel tank level reached one-fourth of the fuel tank volume or less. To ensure proper fueling, SwRI designed and installed an electronic light device on each test vehicle to monitor the fuel level. The device was triggered by the vehicle's fuel gauge sending unit voltage. Once a vehicle's fuel tank level reached one-fourth of the fuel tank volume or less, the device illuminated a light bulb and a light emitting diode (LED). The light bulb indicated a fuel add was needed, while the LED matched the fuel color code that needed to be added. To avoid false indications caused by vehicle shaking or signal noise, the device was designed to illuminate the bulb only after detecting a continuous low fuel signal for one minute.

SwRI technicians were trained to monitor the fuel indicator light device carefully during each test shift. Once the light signal was detected, a MAD technician stopped the vehicle and informed a fuel technician of the need for a fuel-add. MAD and fuel technicians then verified the vehicle operation log sheet, which included fuel code and LED color code. After the fuel-add, this same information was recorded on the fuel log sheet.

EX4, the first test vehicle using the alternating fuel sequence, experienced an improper fueling at the beginning of the test program. EX4 was then restarted on RUN1, but to further ensure that the correct fuel was placed in the test vehicles performing the alternating fuel sequence, color coded magnetic placards were attached to these vehicles. The color of the placard matched the color code of the current fuel in the vehicle's tank. The placard displayed the fuel code of the current fuel, time and mileage of the current fuel add as well as the next fuel code to be added, and the predicted time and mileage for the add. MAD technicians verified and updated the placard information at every fuel add.

Each vehicle's original tires were used during MAD mileage accumulation. At the end of each run, emissions test wheels were placed on the drive axle before emission tests were conducted. Two sets of emissions test wheels were used for each vehicle group, except for the Dodge Caravans. While DC1, DC2, and DC3 shared the two common sets, DC4 used its own set because it had a tire size different from the others.

Fluid levels and tire pressures were regularly checked during mileage accumulation. No vehicle was out of service for longer than a 2-day period. FE3, a 1996 Ford Escort test vehicle, experienced an unrepairable problem after running for four days. It was removed from the program and replaced by another 1996 Ford Escort, FE5. Each vehicle's maintenance history is recorded in Appendix C.

D. EMISSIONS TEST OPERATION

For the emissions testing, each vehicle was brought to the test site with emissions tires in place and the appropriate fuel in the vehicle fuel tank. One vehicle from each vehicle set (Number 1 or Number 2) was utilized to determine the dynamometer road load settings for all four vehicles in that particular set.

To perform coastdowns to derive "a", "b", and "c" chassis dynamometer coefficients using the Mears Model, initial values for road load horsepower and inertia weight were estimated and input into the dynamometer control computer. As starting values for the dyno settings, the equivalent test weight (ETW) for twin-roll hydrokinetic dynamometer testing was obtained from Mr. Peter Hutchins of EPA-Ann Arbor. Initial horsepower settings were obtained from EPA Inspection and Maintenance lookup tables. The dyno inertia weights and horsepower settings used in testing each vehicle set are presented in Table 6.

Table 6. Dynamometer Inertia Test Weight and Road Load Horsepower Settings

Vehicle Set	Inertia Test Weight, lbs.	Road Load at 50 mph, hp
Ford Explorer	4500	13.46
Chevrolet 1500	5250	13.68
Honda Accord	3375	8.34
Ford F-150	5000	14.88
Ford Escort	2875	7.14
Dodge Caravan	4000	10.17
Buick LeSabre/Oldsmobile 88	3750	9.72

Emissions data from the initial FTP test conducted on each vehicle (either as a separate preliminary FTP test or as a part of the first test sequence) were reviewed to determine if the vehicle was an acceptable test vehicle for the program (i.e., emissions that were 125 percent or less of the emission standards for that vehicle). All 29 vehicles undergoing emissions testing in this program had acceptable emissions for this first test. All vehicles were prepped with an FTP, US06, HFET sequence; soaked overnight; and tested the following day using the same FTP, US06, HFET sequence. After the RUN1 and RUN2 mileage accumulations, each day that any vehicle could not be tested the day following mileage accumulation it was operated using an FTP cycle until testing could begin. After duplicate (or triplicate when required) test sequences were completed, the vehicle was returned for additional mileage or reached the end of testing.

IV. EXHAUST EMISSION TEST RESULTS

During the course of this program, emission tests were conducted on a total of 29 different vehicles. One Ford Escort (FE3) experienced mechanical problems during RUN1 operation and was replaced with another Ford Escort (FE5). The initial testing with FE3 brought the total number of vehicles, on which some emissions tests were conducted, to 29 (28 planned vehicles plus one additional vehicle).

The 28 test vehicles that completed this program were evaluated for regulated exhaust emissions and fuel economy in duplicate, or triplicate when repeatability criteria were not met, at three different times over the FTP, the US06, and the HFET sequence. The three test times were at the initial test point (baseline), after RUN1 operation on the mileage accumulation dynamometers, and after RUN2 operation on the mileage accumulation dynamometers. The exhaust emissions measured included total hydrocarbons (THC), carbon monoxide (CO), oxides of nitrogen (NO_x), and non-methane hydrocarbons (NMHC). Carbon dioxide emissions (CO_2) were also determined in order to calculate vehicle fuel economy by the carbon balance method. Average test results for each of the 28 vehicles are summarized in Tables 7, 8, and 9.

Each emissions test number is represented as VVW-XXXX where

VV indicates the vehicle make/model

EX	Ford Explorer
GC	Chevrolet 1500
HA	Honda Accord
FF	Ford F150
FE	Ford Escort
DC	Dodge Caravan
GP	Buick LeSabre or Oldsmobile 88

W indicates the vehicle within a make/model set

1, 2, 3, 4, or 5

XXXX indicates when the test was run

BASE	at the start of test
RUN1	after the first 8,000 miles on the MADs
RUN2	after the second 8,000 miles on the MADs

As mentioned earlier, one Ford Escort (FE3) experienced mechanical problems and was dropped from the program. Two separate sets of initial tests were conducted with this vehicle. After the first set of initial tests, the vehicle required repairs and a second set of initial tests was run. However, continued problems with this vehicle resulted in its removal from the program. A misfueling episode during the RUN1 operation with one of the Ford Explorers (EX4) also resulted in a second set of initial tests on a test vehicle. Due to higher than expected NO_x emissions for FF4 after the RUN2 operation, the vehicle's exhaust gas recirculation (EGR) valve was inspected. Deposits were found to be completely plugging one of the two EGR ports. The valve was replaced and a second set of RUN2 emissions tests were run on FF4.

Table 7. Average FTP Exhaust Emission Rates And Fuel Economy

Vehicle/ Test	Emissions, g/mi			Fuel Economy, mi/gal
	NMHC	CO	NO_x	
EX1-BASE	0.036	0.716	0.039	17.455
EX1-RUN1	0.036	0.810	0.037	17.605
EX1-RUN2	0.034	0.685	0.043	17.877
EX2-BASE	0.044	0.939	0.041	17.442
EX2-RUN1	0.035	0.754	0.041	17.712
EX2-RUN2	0.044	0.818	0.044	18.032
EX3-BASE	0.042	0.887	0.039	17.480
EX3-RUN1	0.036	0.784	0.043	17.764
EX3-RUN2	0.038	0.952	0.043	17.596
EX4-BASE (first)	0.035	0.688	0.034	17.559
EX4-BASE (second)	0.033	0.692	0.035	17.618
EX4-RUN1	0.034	0.670	0.036	17.712
EX4-RUN2	0.042	0.708	0.038	17.592
GC1-BASE	0.197	2.667	0.323	15.179
GC1-RUN1	0.207	2.727	0.342	15.319
GC1-RUN2	0.184	2.506	0.348	15.736
GC2-BASE	0.235	3.312	0.470	15.188
GC2-RUN1	0.228	2.999	0.426	15.465
GC2-RUN2	0.237	3.236	0.438	15.589
GC3-BASE	0.193	2.607	0.309	15.286
GC3-RUN1	0.185	2.483	0.360	15.626
GC3-RUN2	0.205	2.511	0.404	15.547
GC4-BASE	0.221	3.046	0.379	15.385
GC4-RUN1	0.229	3.081	0.381	15.666
GC4-RUN2	0.234	3.157	0.398	15.539

Table 7 (Cont'd). Average FTP Exhaust Emission Rates and Fuel Economy

Vehicle/ Test	Emissions, g/mi			Fuel Economy, mi/gal
	NMHC	CO	NO_x	
HA1-BASE	0.049	1.335	0.102	26.616
HA1-RUN1	0.049	1.271	0.103	26.545
HA1-RUN2	0.057	1.943	0.108	26.531
HA2-BASE	0.052	1.413	0.088	26.179
HA2-RUN1	0.059	1.279	0.098	26.583
HA2-RUN2	0.062	1.723	0.077	26.104
HA3-BASE	0.049	1.107	0.062	26.886
HA3-RUN1	0.047	1.063	0.080	26.733
HA3-RUN2	0.054	1.312	0.114	27.228
HA4-BASE	0.049	0.883	0.061	26.051
HA4-RUN1	0.057	1.373	0.069	25.892
HA4-RUN2	0.059	1.531	0.078	25.782
FF1-BASE	0.122	1.553	0.126	16.561
FF1-RUN1	0.128	1.575	0.131	16.957
FF1-RUN2	0.128	1.531	0.169	17.166
FF2-BASE	0.148	1.715	0.138	16.611
FF2-RUN1	0.137	1.581	0.120	16.667
FF2-RUN2	0.156	1.844	0.136	16.744
FF3-BASE	0.153	1.968	0.101	16.609
FF3-RUN1	0.143	1.907	0.143	16.917
FF3-RUN2	0.141	1.673	0.168	17.027
FF4-BASE	0.139	1.839	0.088	16.700
FF4-RUN1	0.126	1.694	0.170	16.646
FF4-RUN2 (first)	0.146	1.807	0.200	16.638
FF4-RUN2 (second)	0.157	2.186	0.148	16.745

Table 7 (Cont'd). Average FTP Exhaust Emission Rates and Fuel Economy

Vehicle/ Test	Emissions, g/mi			Fuel Economy, mi/gal
	NMHC	CO	NO_x	
FE1-BASE	0.077	1.281	0.228	28.485
FE1-RUN1	0.067	1.291	0.316	28.810
FE1-RUN2	0.078	1.434	0.343	29.065
FE2-BASE	0.077	1.545	0.372	27.696
FE2-RUN1	0.083	1.894	0.474	28.668
FE2-RUN2	0.081	2.399	0.523	29.062
FE5-BASE	0.085	1.160	0.249	28.591
FE5-RUN1	0.084	1.272	0.345	28.529
FE5-RUN2	0.085	1.462	0.383	29.249
FE4-BASE	0.078	1.534	0.389	27.484
FE4-RUN1	0.077	1.600	0.407	28.899
FE4-RUN2	0.082	1.752	0.428	28.644
DC1-BASE	0.141	1.054	0.420	21.039
DC1-RUN1	0.143	1.084	0.393	21.416
DC1-RUN2	0.146	0.997	0.388	21.396
DC2-BASE	0.199	1.411	0.681	20.193
DC2-RUN1	0.204	1.667	0.713	20.956
DC2-RUN2	0.250	2.297	0.733	20.282
DC3-BASE	0.174	1.479	0.512	20.472
DC3-RUN1	0.167	1.409	0.482	21.181
DC3-RUN2	0.188	1.662	0.521	20.765
DC4-BASE	0.151	1.299	0.527	20.050
DC-4-RUN1	0.178	1.707	0.461	20.525
DC4-RUN2	0.205	1.882	0.436	20.278

Table 7 (Cont'd). Average FTP Exhaust Emission Rates and Fuel Economy

Vehicle/ Test	Emissions, g/mi			Fuel Economy, mi/gal
	NMHC	CO	NO_x	
GP1-BASE	0.101	0.919	0.256	19.493
GP1-RUN1	0.126	1.303	0.204	19.703
GP1-RUN2	0.135	1.226	0.237	19.726
GP2-BASE	0.073	0.930	0.118	20.986
GP2-RUN1	0.072	0.745	0.160	20.685
GP2-RUN2	0.077	0.822	0.154	20.512
GP3-BASE	0.089	1.085	0.102	20.350
GP3-RUN1	0.080	0.890	0.138	20.228
GP3-RUN2	0.100	1.128	0.197	19.935
GP4-BASE	0.060	0.647	0.148	18.917
GP4-RUN1	0.061	0.617	0.174	19.225
GP4-RUN2	0.071	0.704	0.183	18.578

Table 8. Average US06 Exhaust Emission Rates and Fuel Economy

Vehicle/ Test	Emissions, g/mi			Fuel Economy, mi/gal
	NMHC	CO	NO_x	
EX1-BASE	0.028	3.742	0.136	15.894
EX1-RUN1	0.013	4.386	0.115	17.122
EX1-RUN2	0.013	4.238	0.172	17.578
EX2-BASE	0.018	2.482	0.150	17.064
EX2-RUN1	0.010	2.749	0.125	17.121
EX2-RUN2	0.016	2.612	0.151	17.825
EX3-BASE	0.032	4.789	0.087	16.553
EX3-RUN1	0.008	2.560	0.099	17.343
EX3-RUN2	0.024	3.952	0.103	17.418
EX4-BASE (first)	0.020	3.567	0.136	17.008
EX4-BASE (second)	0.015	4.439	0.095	17.092
EX4-RUN1	0.014	2.852	0.111	17.724
EX4-RUN2	0.013	2.894	0.121	17.308
GC1-BASE	0.034	0.992	0.526	15.421
GC1-RUN1	0.035	0.843	0.532	15.602
GC1-RUN2	0.037	1.360	0.567	16.291
GC2-BASE	0.035	1.419	0.853	15.523
GC2-RUN1	0.035	1.117	0.812	16.056
GC2-RUN2	0.042	1.921	0.768	15.959
GC3-BASE	0.046	3.061	0.665	15.280
GC3-RUN1	0.044	2.296	0.671	16.071
GC3-RUN2	0.048	2.469	0.766	15.778
GC4-BASE	0.028	0.988	0.701	15.832
GC4-RUN1	0.042	1.824	0.716	15.840
GC4-RUN2	0.039	1.426	0.658	15.881

Table 8 (Cont'd). Average US06 Exhaust Emission Rates and Fuel Economy

Vehicle/ Test	Emissions, g/mi			Fuel Economy, mi/gal
	NMHC	CO	NO_x	
HA1-BASE	0.020	13.560	0.051	25.251
HA1-RUN1	0.014	10.231	0.053	26.083
HA1-RUN2	0.025	14.410	0.089	26.036
HA2-BASE	0.024	16.124	0.028	24.725
HA2-RUN1	0.021	14.181	0.032	24.973
HA2-RUN2	0.016	12.981	0.054	26.170
HA3-BASE	0.022	12.261	0.041	26.142
HA3-RUN1	0.017	11.340	0.072	26.100
HA3-RUN2	0.024	14.363	0.066	26.121
HA4-BASE	0.027	13.574	0.027	25.212
HA4-RUN1	0.024	14.015	0.025	25.247
HA4-RUN2	0.020	16.167	0.034	25.066
FF1-BASE	0.043	12.102	0.187	15.720
FF1-RUN1	0.046	13.351	0.146	16.121
FF1-RUN2	0.026	7.695	0.346	16.498
FF2-BASE	0.062	21.944	0.234	15.374
FF2-RUN1	0.085	23.091	0.148	15.556
FF2-RUN2	0.081	24.093	0.196	15.773
FF3-BASE	0.053	19.116	0.117	15.860
FF3-RUN1	0.104	24.387	0.163	16.186
FF3-RUN2	0.098	22.775	0.148	16.138
FF4-BASE	0.059	20.715	0.190	16.027
FF4-RUN1	0.074	21.040	0.569	15.617
FF4-RUN2 (first)	0.072	18.328	0.745	16.105
FF4-RUN2 (second)	0.071	19.277	0.203	15.846

Table 8 (Cont'd). Average US06 Exhaust Emission Rates and Fuel Economy

Vehicle/ Test	Emissions, g/mi			Fuel Economy, mi/gal
	NMHC	CO	NO_x	
FE1-BASE	0.101	23.401	0.242	26.502
FE1-RUN1	0.074	21.802	0.349	27.196
FE1-RUN2	0.118	25.809	0.372	26.517
FE2-BASE	0.098	21.672	0.525	26.962
FE2-RUN1	0.150	28.010	0.597	26.587
FE2-RUN2	0.161	28.840	0.628	27.207
FE5-BASE	0.215	28.639	0.223	26.734
FE5-RUN1	0.170	27.324	0.288	27.318
FE5-RUN2	0.169	26.622	0.344	27.539
FE4-BASE	0.169	29.192	0.425	26.241
FE4-RUN1	0.155	26.286	0.470	27.337
FE4-RUN2	0.137	26.371	0.495	26.874
DC1-BASE	0.162	24.223	0.629	18.988
DC1-RUN1	0.152	20.144	0.603	19.952
DC1-RUN2	0.212	23.522	0.630	20.064
DC2-BASE	0.182	19.535	0.958	19.093
DC2-RUN1	0.195	21.733	0.960	19.499
DC2-RUN2	0.209	19.378	1.083	19.538
DC3-BASE	0.174	22.341	0.656	19.516
DC3-RUN1	0.118	14.523	0.657	20.812
DC3-RUN2	0.078	7.801	0.643	21.070
DC4-BASE	0.143	20.680	0.813	19.004
DC-4-RUN1	0.172	22.509	0.731	19.151
DC4-RUN2	0.168	18.753	0.827	19.629

Table 8 (Cont'd). Average US06 Exhaust Emission Rates and Fuel Economy

Vehicle/ Test	Emissions, g/mi			Fuel Economy, mi/gal
	NMHC	CO	NO_x	
GP1-BASE	0.052	9.163	0.298	20.390
GP1-RUN1	0.148	10.827	0.261	20.068
GP1-RUN2	0.154	11.059	0.354	20.191
GP2-BASE	0.052	7.625	0.151	21.543
GP2-RUN1	0.041	6.423	0.181	21.158
GP2-RUN2	0.034	5.421	0.228	21.496
GP3-BASE	0.069	10.602	0.085	21.177
GP3-RUN1	0.044	9.328	0.078	20.523
GP3-RUN2	0.078	10.937	0.157	20.304
GP4-BASE	0.022	5.300	0.201	20.653
GP4-RUN1	0.023	5.383	0.170	19.849
GP4-RUN2	0.023	3.609	0.240	20.018

Table 9. Average HFET Exhaust Emission Rates and Fuel Economy

Vehicle/ Test	Emissions, g/mi			Fuel Economy, mi/gal
	NMHC	CO	NO_x	
EX1-BASE	0.004	0.473	0.012	26.214
EX1-RUN1	0.001	0.522	0.014	26.812
EX1-RUN2	0.001	0.315	0.012	27.248
EX2-BASE	0.009	0.628	0.033	26.629
EX2-RUN1	0.001	0.506	0.011	26.867
EX2-RUN2	0.003	0.545	0.012	27.245
EX3-BASE	0.009	0.754	0.040	26.410
EX3-RUN1	0.003	0.495	0.017	27.058
EX3-RUN2	0.005	0.548	0.027	26.647
EX4-BASE (first)	0.004	0.448	0.012	26.609
EX4-BASE (second)	0.001	0.334	0.008	26.982
EX4-RUN1	0.004	0.646	0.020	26.755
EX4-RUN2	0.005	0.620	0.011	26.691
GC1-BASE	0.003	0.060	0.325	23.153
GC1-RUN1	0.003	0.075	0.332	23.600
GC1-RUN2	0.004	0.069	0.358	24.044
GC2-BASE	0.004	0.090	0.480	23.153
GC2-RUN1	0.003	0.080	0.400	23.567
GC2-RUN2	0.004	0.104	0.398	23.627
GC3-BASE	0.006	0.176	0.312	23.341
GC3-RUN1	0.005	0.131	0.309	23.877
GC3-RUN2	0.006	0.168	0.290	24.042
GC4-BASE	0.004	0.065	0.493	23.559
GC4-RUN1	0.006	0.089	0.510	23.764
GC4-RUN2	0.005	0.109	0.457	23.595

Table 9 (Cont'd). Average HFET Exhaust Emission Rates and Fuel Economy

Vehicle/ Test	Emissions, g/mi			Fuel Economy, mi/gal
	NMHC	CO	NO_x	
HA1-BASE	0.000	0.194	0.011	38.916
HA1-RUN1	0.000	0.274	0.007	39.294
HA1-RUN2	0.001	0.357	0.013	39.272
HA2-BASE	0.000	0.129	0.003	38.321
HA2-RUN1	0.001	0.172	0.004	39.007
HA2-RUN2	0.001	0.176	0.006	39.385
HA3-BASE	0.001	0.114	0.004	38.937
HA3-RUN1	0.001	0.205	0.007	39.605
HA3-RUN2	0.001	0.257	0.007	40.558
HA4-BASE	0.002	0.189	0.004	37.929
HA4-RUN1	0.001	0.257	0.004	37.752
HA4-RUN2	0.001	0.369	0.005	37.722
FF1-BASE	0.001	0.063	0.008	26.060
FF1-RUN1	0.000	0.056	0.007	27.117
FF1-RUN2	0.000	0.070	0.007	27.420
FF2-BASE	0.002	0.090	0.016	26.235
FF2-RUN1	0.003	0.113	0.013	25.596
FF2-RUN2	0.002	0.063	0.007	26.631
FF3-BASE	0.003	0.190	0.003	26.692
FF3-RUN1	0.005	0.248	0.007	27.007
FF3-RUN2	0.004	0.212	0.013	26.852
FF4-BASE	0.000	0.068	0.012	26.789
FF4-RUN1	0.000	0.051	0.066	26.764
FF4-RUN2 (first)	0.001	0.036	0.127	26.847
FF4-RUN2 (second)	0.006	0.240	0.009	26.253

Table 9 (Cont'd). Average HFET Exhaust Emission Rates and Fuel Economy

Vehicle/ Test	Emissions, g/mi			Fuel Economy, mi/gal
	NMHC	CO	NO_x	
FE1-BASE	0.008	0.292	0.057	40.937
FE1-RUN1	0.008	0.316	0.095	41.213
FE1-RUN2	0.009	0.378	0.121	41.257
FE2-BASE	0.005	0.651	0.151	41.396
FE2-RUN1	0.005	0.818	0.201	41.736
FE2-RUN2	0.007	0.975	0.244	42.281
FE5-BASE	0.010	0.266	0.073	43.504
FE5-RUN1	0.008	0.179	0.087	44.327
FE5-RUN2	0.008	0.245	0.117	44.194
FE4-BASE	0.005	0.526	0.142	41.632
FE4-RUN1	0.005	0.451	0.144	42.650
FE4-RUN2	0.005	0.608	0.156	41.508
DC1-BASE	0.012	0.342	0.213	30.604
DC1-RUN1	0.013	0.408	0.164	31.742
DC1-RUN2	0.022	0.569	0.123	32.108
DC2-BASE	0.011	0.241	0.436	29.252
DC2-RUN1	0.017	0.446	0.317	29.968
DC2-RUN2	0.019	0.550	0.354	29.703
DC3-BASE	0.015	0.705	0.136	29.632
DC3-RUN1	0.015	0.673	0.135	31.356
DC3-RUN2	0.014	0.760	0.138	30.464
DC4-BASE	0.012	0.423	0.261	28.953
DC4-RUN1	0.016	0.611	0.200	30.454
DC4-RUN2	0.015	0.615	0.191	30.610

Table 9 (Cont'd). Average HFET Exhaust Emission Rates and Fuel Economy

Vehicle/ Test	Emissions, g/mi			Fuel Economy, mi/gal
	NMHC	CO	NO_x	
GP1-BASE	0.003	0.431	0.139	30.840
GP1-RUN1	0.011	0.917	0.119	30.256
GP1-RUN2	0.010	0.822	0.165	30.630
GP2-BASE	0.002	0.138	0.079	33.229
GP2-RUN1	0.001	0.075	0.120	33.201
GP2-RUN2	0.001	0.101	0.157	33.075
GP3-BASE	0.010	0.393	0.028	31.742
GP3-RUN1	0.005	0.252	0.055	32.286
GP3-RUN2	0.004	0.340	0.125	31.960
GP4-BASE	0.001	0.155	0.099	30.191
GP4-RUN1	0.002	0.159	0.209	30.229
GP4-RUN2	0.002	0.191	0.177	29.819

APPENDIX A

TEST VEHICLE OIL CONSUMPTION RESULTS

EX1 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.845	Weight of clean pan	-	0.655
weight of container after oil poured engine	-	0.7	Remove oil filter, weigh used filter		2.07
weight of new dry oil filter	+	0.945	Weight of pan & drained oil	+	8.575
Total		10.09 *start*	Total		9.99 *end*

Oil consumption

= *start* - *end* = 0.1 lbs = 45.4 grams = 53.2 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.79	Weight of clean pan	-	0.67
weight of container after oil poured engine	-	0.68	Remove oil filter, weigh used filter	+	2.025
weight of new dry oil filter	+	0.945	Weight of pan & drained oil	+	7.91
Total		10.055 *start*	Total		9.265 *end*

Oil consumption

= *start* - *end* = 0.79 lbs = 358.3 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.28	Weight of clean pan	-	0.645
weight of container after oil poured engine	-	0.70	Remove oil filter, weigh used filter	+	8.64
weight of new dry oil filter	+	0.935	Weight of pan & drained oil	+	2.00
Total		10.515 *start*	Total		9.995 *end*

Oil consumption

= *start* - *end* = 0.52 lbs = 235.9 grams

RUN TWO 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.855	Weight of clean pan	-	0.705
weight of container after oil poured engine	-	0.745	Remove oil filter, weigh used filter	+	2.06
weight of new dry oil filter	+	0.935	Weight of pan & drained oil	+	8.065
Total		10.045 *start*	Total		9.42 *end*

Oil consumption

= *start* - *end* = 0.625 lbs = 283.5 grams

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.77	Weight of clean pan	-	0.65
weight of container after oil poured engine	-	1.42	Remove oil filter, weigh used filter	+	2.25
weight of new dry oil filter	+	0.945	Weight of pan & drained oil	+	8.11
Total		10.295 *start*	Total		9.71 *end*

Oil consumption

= *start* - *end* = 0.585 lbs = 265.4 grams

EX2 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.375	Weight of clean pan	-	0.66
weight of container after oil poured engine	-	1.485	Remove oil filter, weigh used filter	+	2.02
weight of new dry oil filter	+	0.94	Weight of pan & drained oil	+	8.16
Total		9.83 *start*	Total		9.52 *end*

Oil consumption

= *start* - *end* = 0.31 lbs = 140.6 grams = 165.0 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.785	Weight of clean pan		0.655
weight of container after oil poured engine	-	0.73	Remove oil filter, weigh used filter	+	2.07
weight of new dry oil filter	+	0.945	Weight of pan & drained oil	+	7.79
Total		10.0 *start*	Total		9.205 *end*

Oil consumption

= *start* - *end* = 0.795 lbs = 360.6 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.26	Weight of clean pan		0.74
weight of container after oil poured engine	-	1.59	Remove oil filter, weigh used filter		2.02
weight of new dry oil filter	+	0.93	Weight of pan & drained oil	+	7.475
Total		9.6 *start*	Total		8.755 *end*

Oil consumption

= *start* - *end* = 0.845 lbs = 383.3 grams

RUN TWO 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.02	Weight of clean pan		0.685
weight of container after oil poured engine	-	0.85	Remove oil filter, weigh used filter		2.025
weight of new dry oil filter	+	0.93	Weight of pan & drained oil	+	7.25
Total		10.1 *start*	Total		8.59 *end*

Oil consumption

= *start* - *end* = 1.51 lbs = 684.9 grams

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.845	Weight of clean pan		0.725
weight of container after oil poured engine	-	1.385	Remove oil filter, weigh used filter		2.065
weight of new dry oil filter	+	0.94	Weight of pan & drained oil	+	7.17
Total		9.4 *start*	Total		8.51 *end*

Oil consumption

= *start* - *end* = 0.89 lbs = 403.7 grams

EX3 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.88	Weight of clean pan		0.645
weight of container after oil poured engine	-	0.715	Remove oil filter, weigh used filter	+	2.04
weight of new dry oil filter	+	0.945	Weight of pan & drained oil	+	8.505
Total		10.11 *start*	Total		9.9 *end*

Oil consumption

= *start* - *end* = 0.21 lbs = 95.3 grams = 111.8 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.88	Weight of clean pan		0.655
weight of container after oil poured engine	-	0.71	Remove oil filter, weigh used filter		1.855
weight of new dry oil filter	+	0.95	Weight of pan & drained oil	+	8.09
Total		10.12 *start*	Total		9.29 *end*

Oil consumption

= *start* - *end* = 0.83 lbs = 376.5 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.795	Weight of clean pan		0.66
weight of container after oil poured engine	-	0.70	Remove oil filter, weigh used filter		1.99
weight of new dry oil filter	+	0.93	Weight of pan & drained oil	+	7.99
Total		10.025 *start*	Total		9.32 *end*

Oil consumption

= *start* - *end* = 0.705 lbs = 319.8 grams

RUN TWO 4,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	9.99	Weight of clean pan	0.665
weight of container after oil poured engine	-	0.955	Remove oil filter, weigh used filter	2.05
weight of new dry oil filter	+	0.945	Weight of pan & drained oil	+ 7.77
Total		9.98 *start*	Total	9.155 *end*

Oil consumption

= *start* - *end* = 0.825 lbs = 374.2 gram

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	9.69	Weight of clean pan	0.645
weight of container after oil poured engine	-	0.685	Remove oil filter, weigh used filter	2.11
weight of new dry oil filter	+	0.935	Weight of pan & drained oil	+ 7.92
Total		9.94 *start*	Total	9.385 *end*

Oil consumption

= *start* - *end* = 0.555 lbs = 251.7 grams

EX4 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.095	Weight of clean pan	-	0.645
weight of container after oil poured engine	-	1.205	Remove oil filter, weigh used filter	+	2.035
weight of new dry oil filter	+	0.945	Weight of pan & drained oil	+	8.235
Total		9.835 *start*	Total		9.625 *end*

Oil consumption

= *start* - *end* = 0.21 lbs = 95.3 grams = 111.8 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.7	Weight of clean pan		0.65
weight of container after oil poured engine	-	1.785	Remove oil filter, weigh used filter		2.055
weight of new dry oil filter	+	0.94	Weight of pan & drained oil	+	7.595
Total		9.855 *start*	Total		6.19 *end*

Oil consumption

= *start* - *end* = 3.665 lbs = 1662.4 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.165	Weight of clean pan		0.65
weight of container after oil poured engine	-	0.705	Remove oil filter, weigh used filter		2.025
weight of new dry oil filter	+	0.94	Weight of pan & drained oil	+	8.36
Total		10.4 *start*	Total		9.735 *end*

Oil consumption

= *start* - *end* = 0.665 lbs = 301.6 grams

RUN TWO 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.775	Weight of clean pan		0.65
weight of container after oil poured engine	-	1.995	Remove oil filter, weigh used filter		2.07
weight of new dry oil filter	+	0.945	Weight of pan & drained oil	+	7.48
Total		9.725 *start*	Total		8.9 *end*

Oil consumption

= *start* - *end* = 0.825 lbs = 374.2 gram

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	11.49	Weight of clean pan		0.68
weight of container after oil poured engine	-	2.515	Remove oil filter, weigh used filter		1.93
weight of new dry oil filter	+	0.94	Weight of pan & drained oil	+	7.88
Total		9.915 *start*	Total		9.13 *end*

Oil consumption

= *start* - *end* = 0.785 lbs = 356.1 grams

GC1 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**	
Weight of new test oil/pan	+	10.615	Weight of clean pan	0.67
weight of container after oil poured engine	-	1.65	Remove oil filter, weigh used filter	1.515
weight of new dry oil filter	+	0.98	Weight of pan & drained oil	+ 8.98
Total		9.945 *start*	Total	9.825 *end*

Oil consumption

= *start* - *end* = 0.12 lbs = 54.4 grams = 63.9 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	9.825	Weight of clean pan	0.66
weight of container after oil poured engine	-	0.675	Remove oil filter, weigh used filter	2.125
weight of new dry oil filter	+	0.975	Weight of pan & drained oil	+ 6.505
Total		10.125 *start*	Total	7.97 *end*

Oil consumption

= *start* - *end* = 2.155 lbs = 977.5 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	9.385	Weight of clean pan	0.66
weight of container after oil poured engine	-	0.68	Remove oil filter, weigh used filter	2.435
weight of new dry oil filter	+	1.005	Weight of pan & drained oil	+ 6.755
Total		9.71 *start*	Total	8.53 *end*

Oil consumption

= *start* - *end* = 1.18 lbs = 535.2 grams

RUN TWO 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.87	Weight of clean pan		0.65
weight of container after oil poured engine	-	0.68	Remove oil filter, weigh used filter		1.63
weight of new dry oil filter	+	0.975	Weight of pan & drained oil	+	7.755
Total		10.165 *start*	Total		8.735 *end*

Oil consumption

= *start* - *end* = 1.43 lbs = 648.6 gram

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	11.375	Weight of clean pan		0.655
weight of container after oil poured engine	-	1.985	Remove oil filter, weigh used filter		2.445
weight of new dry oil filter	+	1.005	Weight of pan & drained oil	+	7.14
Total		10.395 *start*	Total		8.93 *end*

Oil consumption

= *start* - *end* = 1.465 lbs = 664.5 grams

GC2 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**	
Weight of new test oil/pan	+	11.99	Weight of clean pan	0.645
weight of container after oil poured engine	-	2.45	Remove oil filter, weigh used filter	2.115
weight of new dry oil filter	+	0.995	Weight of pan & drained oil	+ 8.895
Total		10.535 *start*	Total	10.365 *end*

Oil consumption

= *start* - *end* = 0.17 lbs = 77.1 grams = 90.5 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	10.95	Weight of clean pan	0.67
weight of container after oil poured engine	-	1.31	Remove oil filter, weigh used filter	2.135
weight of new dry oil filter	+	1.00	Weight of pan & drained oil	+ 7.13
Total		10.64 *start*	Total	8.595 *end*

Oil consumption

= *start* - *end* = 2.045 lbs = 927.6 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	10.765	Weight of clean pan	0.68
weight of container after oil poured engine	-	0.95	Remove oil filter, weigh used filter	1.54
weight of new dry oil filter	+	0.99	Weight of pan & drained oil	+ 8.32
Total		10.805 *start*	Total	9.18 *end*

Oil consumption

= *start* - *end* = 1.625 lbs = 737.1 grams

RUN TWO 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.82	Weight of clean pan		0.68
weight of container after oil poured engine	-	0.98	Remove oil filter, weigh used filter		2.09
weight of new dry oil filter	+	0.71	Weight of pan & drained oil	+	7.8
Total		10.55 *start*	Total		9.21 *end*

Oil consumption

= *start* - *end* = 1.34 lbs = 607.8 gram

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	11.08	Weight of clean pan		0.65
weight of container after oil poured engine	-	1.405	Remove oil filter, weigh used filter		2.11
weight of new dry oil filter	+	1.005	Weight of pan & drained oil	+	7.595
Total		10.68 *start*	Total		9.055 *end*

Oil consumption

= *start* - *end* = 1.625 lbs = 737.1 grams

GC3 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.945	Weight of clean pan		0.655
weight of container after oil poured engine	-	1.305	Remove oil filter, weigh used filter		2.1
weight of new dry oil filter	+	1	Weight of pan & drained oil	+	8.83
Total		10.64 *start*	Total		10.275 *end*

Oil consumption

= *start* - *end* = 0.365 lbs = 165.6 grams = 194.3 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.91	Weight of clean pan		0.675
weight of container after oil poured engine	-	0.69	Remove oil filter, weigh used filter		2.065
weight of new dry oil filter	+	0.97	Weight of pan & drained oil	+	6.85
Total		10.88 *start*	Total		8.24 *end*

Oil consumption

= *start* - *end* = 2.64 lbs = 1197.5 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	11.335	Weight of clean pan		0.64
weight of container after oil poured engine	-	1.895	Remove oil filter, weigh used filter		2.1
weight of new dry oil filter	+	0.995	Weight of pan & drained oil	+	7.2
Total		10.435 *start*	Total		8.66 *end*

Oil consumption

= *start* - *end* = 1.775 lbs = 805.1 grams

RUN TWO 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.525	Weight of clean pan		0.7
weight of container after oil poured engine	-	1.35	Remove oil filter, weigh used filter		1.535
weight of new dry oil filter	+	0.985	Weight of pan & drained oil	+	7.46
Total		10.16 *start*	Total		8.295 *end*

Oil consumption

= *start* - *end* = 1.865 lbs = 846.0 gram

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.865	Weight of clean pan		0.685
weight of container after oil poured engine	-	1.565	Remove oil filter, weigh used filter		2.145
weight of new dry oil filter	+	0.995	Weight of pan & drained oil	+	7.055
Total		10.295 *start*	Total		8.515 *end*

Oil consumption

= *start* - *end* = 1.78 lbs = 807.4 grams

GC4 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**	
Weight of new test oil/pan	+	10.88	Weight of clean pan	0.65
weight of container after oil poured engine	-	1.66	Remove oil filter, weigh used filter	1.615
weight of new dry oil filter	+	1.005	Weight of pan & drained oil	+ 8.8
Total		10.225 *start*	Total	9.765 *end*

Oil consumption

= *start* - *end* = 0.46 lbs = 208.7 grams = 244.9 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	11.07	Weight of clean pan	0.81
weight of container after oil poured engine	-	1.56	Remove oil filter, weigh used filter	2.065
weight of new dry oil filter	+	1	Weight of pan & drained oil	+ 7.355
Total		10.51 *start*	Total	8.61 *end*

Oil consumption

= *start* - *end* = 1.9 lbs = 861.8 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	10.865	Weight of clean pan	0.655
weight of container after oil poured engine	-	1.46	Remove oil filter, weigh used filter	2.45
weight of new dry oil filter	+	0.98	Weight of pan & drained oil	+ 6.76
Total		10.385 *start*	Total	8.555 *end*

Oil consumption

= *start* - *end* = 1.83 lbs = 830.1 grams

RUN TWO 4,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	11.39	Weight of clean pan	0.675
weight of container after oil poured engine	-	1.895	Remove oil filter, weigh used filter	1.995
weight of new dry oil filter	+	0.995	Weight of pan & drained oil	+ 6.95
Total		10.49 *start*	Total	8.27 *end*

Oil consumption

= *start* - *end* = 2.22 lbs = 1007.0 gram

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	10.115	Weight of clean pan	0.65
weight of container after oil poured engine	-	1.135	Remove oil filter, weigh used filter	2.11
weight of new dry oil filter	+	1.01	Weight of pan & drained oil	+ 6.415
Total		9.99 *start*	Total	7.875 *end*

Oil consumption

= *start* - *end* = 2.115 lbs = 959.4 grams

HA1 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**	
Weight of new test oil/pan	+	9.990	Weight of clean pan	0.655
weight of container after oil poured engine	-	1.460	Remove oil filter, weigh used filter	1.245
weight of new dry oil filter	+	0.715	Weight of pan & drained oil	+ 8.420
Total		9.245 *start*	Total	9.01 *end*

Oil consumption

= *start* - *end* = 0.235 lbs = 106.6 grams = 125.1 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	9.740	Weight of clean pan	0.645
weight of container after oil poured engine	-	1.295	Remove oil filter, weigh used filter	1.25
weight of new dry oil filter	+	0.720	Weight of pan & drained oil	+ 7.655
Total		9.165 *start*	Total	8.26 *end*

Oil consumption

= *start* - *end* = 0.905 lbs = 410.5 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	9.36	Weight of clean pan	0.7
weight of container after oil poured engine	-	0.73	Remove oil filter, weigh used filter	1.195
weight of new dry oil filter	+	0.705	Weight of pan & drained oil	+ 7.655
Total		9.335 *start*	Total	8.15 *end*

Oil consumption

= *start* - *end* = 1.185 lbs = 537.5 grams

RUN TWO 4,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	9.7	Weight of clean pan	0.675
weight of container after oil poured engine	-	1.175	Remove oil filter, weigh used filter	1.17
weight of new dry oil filter	+	0.72	Weight of pan & drained oil	+ 8.315
Total		9.245 *start*	Total	8.81 *end*

Oil consumption

= *start* - *end* = 0.435 lbs = 197.3 gram

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	10.315	Weight of clean pan	0.68
weight of container after oil poured engine	-	1.6	Remove oil filter, weigh used filter	1.195
weight of new dry oil filter	+	0.725	Weight of pan & drained oil	+ 8.085
Total		9.44 *start*	Total	8.6 *end*

Oil consumption

= *start* - *end* = 0.84 lbs = 381.0 grams

HA2 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**	
Weight of new test oil/pan	+	9.910	Weight of clean pan	0.665
weight of container after oil poured engine	-	1.400	Remove oil filter, weigh used filter	1.010
weight of new dry oil filter	+	0.705	Weight of pan & drained oil	+ 8.830
Total		9.215 *start*	Total	9.175 *end*

Oil consumption

= *start* - *end* = 0.04 lbs = 18.1 grams = 21.3 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	9.025	Weight of clean pan	0.65
weight of container after oil poured engine	-	0.690	Remove oil filter, weigh used filter	1.275
weight of new dry oil filter	+	0.725	Weight of pan & drained oil	+ 7.54
Total		9.06 *start*	Total	8.165 *end*

Oil consumption

= *start* - *end* = 0.895 lbs = 406.0 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	9.905	Weight of clean pan	0.66
weight of container after oil poured engine	-	1.285	Remove oil filter, weigh used filter	1.13
weight of new dry oil filter	+	0.73	Weight of pan & drained oil	+ 8.22
Total		9.35 *start*	Total	8.69 *end*

Oil consumption

= *start* - *end* = 0.66 lbs = 299.4 grams

RUN TWO 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.345	Weight of clean pan		0.65
weight of container after oil poured engine	-	0.68	Remove oil filter, weigh used filter		1.195
weight of new dry oil filter	+	0.725	Weight of pan & drained oil	+	7.725
Total		9.39 *start*	Total		8.27 *end*

Oil consumption

= *start* - *end* = 1.12 lbs = 508.0 gram

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.795	Weight of clean pan		0.675
weight of container after oil poured engine	-	1.38	Remove oil filter, weigh used filter		1.29
weight of new dry oil filter	+	0.725	Weight of pan & drained oil	+	7.97
Total		9.14 *start*	Total		8.585 *end*

Oil consumption

= *start* - *end* = 0.555 lbs = 251.7 grams

HA3 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**	
Weight of new test oil/pan	+	10	Weight of clean pan	0.655
weight of container after oil poured engine	-	1.43	Remove oil filter, weigh used filter	1.2
weight of new dry oil filter	+	0.725	Weight of pan & drained oil	+ 8.61
Total		9.295 *start*	Total	9.155 *end*

Oil consumption

= *start* - *end* = 0.14 lbs = 63.5 grams = 74.5 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	9.45	Weight of clean pan	0.655
weight of container after oil poured engine	-	0.675	Remove oil filter, weigh used filter	1.16
weight of new dry oil filter	+	0.725	Weight of pan & drained oil	+ 8.275
Total		9.5 *start*	Total	8.78 *end*

Oil consumption

= *start* - *end* = 0.72 lbs = 326.6 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	9.79	Weight of clean pan	0.7
weight of container after oil poured engine	-	1	Remove oil filter, weigh used filter	1.175
weight of new dry oil filter	+	0.725	Weight of pan & drained oil	+ 8.325
Total		9.515 *start*	Total	8.8 *end*

Oil consumption

= *start* - *end* = 0.715 lbs = 324.3 grams

RUN TWO 4,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	10.285	Weight of clean pan	0.69
weight of container after oil poured engine	-	1.51	Remove oil filter, weigh used filter	1.085
weight of new dry oil filter	+	0.72	Weight of pan & drained oil	+ 8.39
Total		9.495 *start*	Total	8.785 *end*

Oil consumption

= *start* - *end* = 0.71 lbs = 322.1 gram

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	10.375	Weight of clean pan	0.645
weight of container after oil poured engine	-	1.645	Remove oil filter, weigh used filter	1.18
weight of new dry oil filter	+	0.73	Weight of pan & drained oil	+ 8.19
Total		9.46 *start*	Total	8.725 *end*

Oil consumption

= *start* - *end* = 0.735 lbs = 333.4 grams

HA4 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**	
Weight of new test oil/pan	+	9.7	Weight of clean pan	0.76
weight of container after oil poured engine	-	1.325	Remove oil filter, weigh used filter	1.19
weight of new dry oil filter	+	0.73	Weight of pan & drained oil	+ 8.645
Total		9.105 *start*	Total	9.075 *end*

Oil consumption

= *start* - *end* = 0.03 lbs = 13.6 grams = 16.0 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	10.15	Weight of clean pan	0.68
weight of container after oil poured engine	-	1.46	Remove oil filter, weigh used filter	1.145
weight of new dry oil filter	+	0.725	Weight of pan & drained oil	+ 7.675
Total		9.415 *start*	Total	8.14 *end*

Oil consumption

= *start* - *end* = 1.275 lbs = 578.3 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	10.25	Weight of clean pan	0.805
weight of container after oil poured engine	-	1.775	Remove oil filter, weigh used filter	1.175
weight of new dry oil filter	+	0.726	Weight of pan & drained oil	+ 8.535
Total		9.201 *start*	Total	8.905 *end*

Oil consumption

= *start* - *end* = 0.296 lbs = 134.3 grams

RUN TWO 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.26	Weight of clean pan		0.66
weight of container after oil poured engine	-	1.43	Remove oil filter, weigh used filter		1.185
weight of new dry oil filter	+	0.73	Weight of pan & drained oil	+	8.125
Total		9.56 *start*	Total		8.65 *end*

Oil consumption

= *start* - *end* = 0.91 lbs = 412.8 gram

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.55	Weight of clean pan		0.65
weight of container after oil poured engine	-	1.635	Remove oil filter, weigh used filter		1.09
weight of new dry oil filter	+	0.575	Weight of pan & drained oil	+	7.875
Total		9.49 *start*	Total		8.315 *end*

Oil consumption

= *start* - *end* = 1.175 lbs = 533.0 grams

FF1 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**		
Weight of new test oil/pan	13.915		Weight of clean pan -	0.66	
weight of container after oil poured engi	2.195		Remove oil filter, weigh used filter +	1.795	
weight of new dry oil filter	0.855		Weight of pan & drained oil +	11.105	
Total	12.575	*start*	Total	12.24	*end*

Oil consumption

= *start* - *end* = 0.335 lbs = 152.0 grams = 178.3 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	13.465		Weight of clean pan	2.205	
weight of container after oil poured engi	1.455		Remove oil filter, weigh used filter	1.725	
weight of new dry oil filter	0.845		Weight of pan & drained oil +	12.02	
Total	12.855	*start*	Total	11.54	*end*

Oil consumption

= *start* - *end* = 1.315 lbs = 596.5 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	14.255		Weight of clean pan	2.205	
weight of container after oil poured engi	2.08		Remove oil filter, weigh used filter	1.705	
weight of new dry oil filter	0.85		Weight of pan & drained oil +	11.865	
Total	13.025	*start*	Total	11.365	*end*

Oil consumption

= *start* - *end* = 1.66 lbs = 753.0 grams

RUN TWO 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	14.405		Weight of clean pan	0.78	
weight of container after oil poured engi	3.03		Remove oil filter, weigh used filter	1.695	
weight of new dry oil filter	0.84		Weight of pan & drained oil	+ 9.555	
Total	12.215	*start*	Total	10.47	*end*

Oil consumption

= *start* - *end* = 1.745 lbs = 791.5 gram

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	11.795		Weight of clean pan	1.495	
weight of container after oil poured engi	0.675		Remove oil filter, weigh used filter	1.715	
weight of new dry oil filter	0.84		Weight of pan & drained oil	+ 10.095	
Total	11.96	*start*	Total	10.315	*end*

Oil consumption

= *start* - *end* = 1.645 lbs = 746.2 grams

FF2 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**		
Weight of new test oil/pan	+	16.53	Weight of clean pan	-	0.655
weight of container after oil poured engine	-	3.575	Remove oil filter, weigh used filter	+	1.815
weight of new dry oil filter	+	0.85	Weight of pan & drained oil	+	12.29
Total		13.805 *start*	Total		13.45 *end*

Oil consumption

= *start* - *end* = 0.355 lbs = 161.0 grams = 189.0 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	13.15	Weight of clean pan	-	2.205
weight of container after oil poured engine	-	1.495	Remove oil filter, weigh used filter	+	1.715
weight of new dry oil filter	+	0.845	Weight of pan & drained oil	+	13.405
Total		12.5 *start*	Total		12.915 *end*

Oil consumption

= *start* - *end* = -0.415 lbs = -188.2 grams *

* Note: Due to technical difficulty, 4,000-mile oil change experienced a nagative oil consumption

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	14.215	Weight of clean pan		0.665
weight of container after oil poured engine	-	1.425	Remove oil filter, weigh used filter		1.695
weight of new dry oil filter	+	0.85	Weight of pan & drained oil	+	11.005
Total		13.64 *start*	Total		12.035 *end*

Oil consumption

= *start* - *end* = 1.605 lbs = 728.0 grams

RUN TWO 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	11.985	Weight of clean pan		0.69
weight of container after oil poured engine	-	0.68	Remove oil filter, weigh used filter		1.68
weight of new dry oil filter	+	0.855	Weight of pan & drained oil	+	9.58
Total		12.16 *start*	Total		10.57 *end*

Oil consumption

= *start* - *end* = 1.59 lbs = 721.2 gram

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	11.98	Weight of clean pan		0.645
weight of container after oil poured engine	-	0.66	Remove oil filter, weigh used filter		1.72
weight of new dry oil filter	+	0.85	Weight of pan & drained oil	+	9.775
Total		12.17 *start*	Total		10.85 *end*

Oil consumption

= *start* - *end* = 1.32 lbs = 598.8 grams

FF3 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**		
Weight of new test oil/pan	+	13.995	Weight of clean pan	-	2.215
weight of container after oil poured engine	-	2.61	Remove oil filter, weigh used filter	+	1.7
weight of new dry oil filter	+	0.855	Weight of pan & drained oil	+	12.43
Total		12.24 *start*	Total		11.915 *end*

Oil consumption

= *start* - *end* = 0.325 lbs = 147.4 grams = 173.0 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	15.19	Weight of clean pan	-	0.755
weight of container after oil poured engine	-	3.39	Remove oil filter, weigh used filter	+	1.68
weight of new dry oil filter	+	0.86	Weight of pan & drained oil	+	9.935
Total		12.66 *start*	Total		10.86 *end*

Oil consumption

= *start* - *end* = 1.8 lbs = 816.5 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	11.835	Weight of clean pan		0.655
weight of container after oil poured engine	-	0.905	Remove oil filter, weigh used filter		1.695
weight of new dry oil filter	+	0.84	Weight of pan & drained oil	+	9.085
Total		11.77 *start*	Total		10.125 *end*

Oil consumption

= *start* - *end* = 1.645 lbs = 746.2 grams

RUN TWO 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	14.34	Weight of clean pan		0.675
weight of container after oil poured engine	-	3.215	Remove oil filter, weigh used filter		1.86
weight of new dry oil filter	+	0.855	Weight of pan & drained oil	+	9.075
Total		11.98 *start*	Total		10.26 *end*

Oil consumption

= *start* - *end* = 1.72 lbs = 780.2 gram

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	13.915	Weight of clean pan		2.21
weight of container after oil poured engine	-	2.335	Remove oil filter, weigh used filter		1.44
weight of new dry oil filter	+	0.85	Weight of pan & drained oil	+	11.785
Total		12.43 *start*	Total		11.015 *end*

Oil consumption

= *start* - *end* = 1.415 lbs = 641.8 grams

FF4 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**		
Weight of new test oil/pan	+	12.135	Weight of clean pan	-	0.655
weight of container after oil poured engine	-	0.685	Remove oil filter, weigh used filter	+	1.83
weight of new dry oil filter	+	0.85	Weight of pan & drained oil	+	10.825
Total		12.3 *start*	Total		12 *end*

Oil consumption

= *start* - *end* = 0.3 lbs = 136.1 grams = 159.7 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	16.2	Weight of clean pan	-	2.2
weight of container after oil poured engine	-	4.87	Remove oil filter, weigh used filter	+	1.695
weight of new dry oil filter	+	0.85	Weight of pan & drained oil	+	11.465
Total		12.18 *start*	Total		10.96 *end*

Oil consumption

= *start* - *end* = 1.22 lbs = 553.4 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	12.995	Weight of clean pan		0.645
weight of container after oil poured engine	-	2.11	Remove oil filter, weigh used filter		1.825
weight of new dry oil filter	+	0.845	Weight of pan & drained oil	+	9.38
Total		11.73 *start*	Total		10.56 *end*

Oil consumption

= *start* - *end* = 1.17 lbs = 530.7 grams

RUN TWO 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	13.02	Weight of clean pan		0.6
weight of container after oil poured engine	-	1.885	Remove oil filter, weigh used filter		1.775
weight of new dry oil filter	+	0.845	Weight of pan & drained oil	+	9.69
Total		11.98 *start*	Total		10.865 *end*

Oil consumption

= *start* - *end* = 1.115 lbs = 505.8 gram

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	12.7	Weight of clean pan		0.655
weight of container after oil poured engine	-	1.445	Remove oil filter, weigh used filter		1.685
weight of new dry oil filter	+	0.855	Weight of pan & drained oil	+	9.9
Total		12.11 *start*	Total		10.93 *end*

Oil consumption

= *start* - *end* = 1.18 lbs = 535.2 grams

FE1 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**		
Weight of new test oil/pan	+	8.215	Weight of clean pan	-	0.65
weight of container after oil poured engine	-	1.65	Remove oil filter, weigh used filter	+	1.425
weight of new dry oil filter	+	0.67	Weight of pan & drained oil	+	6.385
Total		7.235 *start*	Total		7.16 *end*

Oil consumption

= *start* - *end* = 0.075 lbs = 34.0 grams = 39.9 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	7.85	Weight of clean pan	-	0.645
weight of container after oil poured engine	-	1.18	Remove oil filter, weigh used filter	+	1.225
weight of new dry oil filter	+	0.665	Weight of pan & drained oil	+	6.13
Total		7.335 *start*	Total		6.71 *end*

Oil consumption

= *start* - *end* = 0.625 lbs = 283.5 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	7.785	Weight of clean pan	-	0.65
weight of container after oil poured engine	-	1.345	Remove oil filter, weigh used filter	+	1.325
weight of new dry oil filter	+	0.66	Weight of pan & drained oil	+	5.535
Total		7.1 *start*	Total		6.21 *end*

Oil consumption

= *start* - *end* = 0.89 lbs = 403.7 grams

RUN TWO 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.195	Weight of clean pan	-	0.66
weight of container after oil poured engine	-	2.25	Remove oil filter, weigh used filter	+	1.445
weight of new dry oil filter	+	0.67	Weight of pan & drained oil	+	6.225
Total		7.615 *start*	Total		7.01 *end*

Oil consumption

= *start* - *end* = 0.605 lbs = 274.4 gram

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.765	Weight of clean pan	-	0.81
weight of container after oil poured engine	-	2.8	Remove oil filter, weigh used filter	+	1.215
weight of new dry oil filter	+	0.67	Weight of pan & drained oil	+	6.495
Total		7.635 *start*	Total		6.9 *end*

Oil consumption

= *start* - *end* = 0.735 lbs = 333.4 grams

FE2 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.22	Weight of clean pan	-	0.65
weight of container after oil poured engine	-	2.725	Remove oil filter, weigh used filter	+	1.185
weight of new dry oil filter	+	0.665	Weight of pan & drained oil	+	6.41
Total		7.16 *start*	Total		6.945 *end*

Oil consumption

= *start* - *end* = 0.215 lbs = 97.5 grams = 114.5 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	8.935	Weight of clean pan	-	0.735
weight of container after oil poured engine	-	2.26	Remove oil filter, weigh used filter	+	1.23
weight of new dry oil filter	+	0.67	Weight of pan & drained oil	+	5.305
Total		7.345 *start*	Total		5.8 *end*

Oil consumption

= *start* - *end* = 1.545 lbs = 700.8 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.615	Weight of clean pan	-	0.68
weight of container after oil poured engine	-	3.445	Remove oil filter, weigh used filter	+	1.22
weight of new dry oil filter	+	0.67	Weight of pan & drained oil	+	6.025
Total		7.84 *start*	Total		6.565 *end*

Oil consumption

= *start* - *end* = 1.275 lbs = 578.3 grams

RUN TWO 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.2	Weight of clean pan	-	0.685
weight of container after oil poured engine	-	3.67	Remove oil filter, weigh used filter	+	1.21
weight of new dry oil filter	+	0.665	Weight of pan & drained oil	+	5.175
Total		7.195 *start*	Total		5.7 *end*

Oil consumption

= *start* - *end* = 1.495 lbs = 678.1 gram

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	8.44	Weight of clean pan		0.805
weight of container after oil poured engine		2.485	Remove oil filter, weigh used filter	+	1.235
weight of new dry oil filter	+	0.675	Weight of pan & drained oil	+	5.405
Total		6.63 *start*	Total		5.835 *end*

Oil consumption

= *start* - *end* = 0.795 lbs = 360.6 grams

FE3 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**		
Weight of new test oil/pan	+	7.875	Weight of clean pan	-	0.675
weight of container after oil poured engine	-	1.535	Remove oil filter, weigh used filter	+	1.19
weight of new dry oil filter	+	0.665	Weight of pan & drained oil	+	6.105
Total		7.005 *start*	Total		6.62 *end*

Oil consumption

= *start* - *end* = 0.385 lbs = 174.6 grams = 204.9 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	8.8	Weight of clean pan	-	0.685
weight of container after oil poured engine	-	2.47	Remove oil filter, weigh used filter	+	1.23
weight of new dry oil filter	+	0.675	Weight of pan & drained oil	+	5.305
Total		7.005 *start*	Total		5.85 *end*

Oil consumption

= *start* - *end* = 1.155 lbs = 523.9 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test ***		
Weight of new test oil/pan	+	8.905	Weight of clean pan	-	
weight of container after oil poured engine	-	2.275	Remove oil filter, weigh used filter	+	
weight of new dry oil filter	+	0.665	Weight of pan & drained oil	+	
Total		7.295 *start*	Total		0 *end*

Oil consumption

= *start* - *end* = lbs = 0.0 grams

* Note: Testing on FE-3 was cancelled.

FE4 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**		
Weight of new test oil/pan	+	8.96	Weight of clean pan	-	0.655
weight of container after oil poured engine	-	2.33	Remove oil filter, weigh used filter	+	1.025
weight of new dry oil filter	+	0.66	Weight of pan & drained oil	+	6.83
Total		7.29 *start*	Total		7.2 *end*

Oil consumption

= *start* - *end* = 0.09 lbs = 40.8 grams = 47.9 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	8.83	Weight of clean pan	-	0.66
weight of container after oil poured engine	-	2.455	Remove oil filter, weigh used filter	+	1.255
weight of new dry oil filter	+	0.67	Weight of pan & drained oil	+	5.35
Total		7.045 *start*	Total		5.945 *end*

Oil consumption

= *start* - *end* = 1.1 lbs = 499.0 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	8.425	Weight of clean pan	-	0.655
weight of container after oil poured engine	-	2.115	Remove oil filter, weigh used filter	+	1
weight of new dry oil filter	+	0.665	Weight of pan & drained oil	+	5.865
Total		6.975 *start*	Total		6.21 *end*

Oil consumption

= *start* - *end* = 0.765 lbs = 347.0 grams

RUN TWO 4,000-mile oil change

Start of Test				**End of Test**		
Weight of new test oil/pan	+	8.16		Weight of clean pan	-	0.66
weight of container after oil poured engine	-	1.8		Remove oil filter, weigh used filter	+	1.2
weight of new dry oil filter	+	0.665		Weight of pan & drained oil	+	5.48
Total		7.025 *start*		Total		6.02 *end*

Oil consumption

= *start* - *end* = 1.005 lbs = 455.9 gram

RUN TWO 8,000-mile oil change

Start of Test				**End of Test**		
Weight of new test oil/pan	+	10.105		Weight of clean pan		0.645
weight of container after oil poured engine		3.845		Remove oil filter, weigh used filter	+	1.23
weight of new dry oil filter	+	0.67		Weight of pan & drained oil	+	5.315
Total		6.93 *start*		Total		5.9 *end*

Oil consumption

= *start* - *end* = 1.03 lbs = 467.2 grams

FE5 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**		
Weight of new test oil/pan	+	8.525	Weight of clean pan	-	0.65
weight of container after oil poured engine	-	1.64	Remove oil filter, weigh used filter	+	1.44
weight of new dry oil filter	+	0.66	Weight of pan & drained oil	+	6.635
Total		7.545 *start*	Total		7.425 *end*

Oil consumption

= *start* - *end* = 0.12 lbs = 54.4 grams = 63.9 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.115	Weight of clean pan	-	0.66
weight of container after oil poured engine	-	2.2	Remove oil filter, weigh used filter	+	1.21
weight of new dry oil filter	+	0.665	Weight of pan & drained oil	+	5.84
Total		7.58 *start*	Total		6.39 *end*

Oil consumption

= *start* - *end* = 1.19 lbs = 539.8 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	8.9	Weight of clean pan	-	0.645
weight of container after oil poured engine	-	1.71	Remove oil filter, weigh used filter	+	1.22
weight of new dry oil filter	+	0.665	Weight of pan & drained oil	+	6.32
Total		7.855 *start*	Total		6.895 *end*

Oil consumption

= *start* - *end* = 0.96 lbs = 435.5 grams

RUN TWO 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.045	Weight of clean pan	-	0.66
weight of container after oil poured engine	-	3.345	Remove oil filter, weigh used filter	+	1.18
weight of new dry oil filter	+	0.665	Weight of pan & drained oil	+	5.785
Total		7.365 *start*	Total		6.305 *end*

Oil consumption

= *start* - *end* = 1.06 lbs = 480.8 gram

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	7.5	Weight of clean pan		0.655
weight of container after oil poured engine		0.88	Remove oil filter, weigh used filter	+	1.21
weight of new dry oil filter	+	0.67	Weight of pan & drained oil	+	5.84
Total		7.29 *start*	Total		6.395 *end*

Oil consumption

= *start* - *end* = 0.895 lbs = 406.0 grams

DC1 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.71	Weight of clean pan	-	0.645
weight of container after oil poured engine	-	0.68	Remove oil filter, weigh used filter	+	1.655
weight of new dry oil filter	+	0.88	Weight of pan & drained oil	+	8.835
Total		9.91 *start*	Total		9.845 *end*

Oil consumption

= *start* - *end* = 0.065 lbs = 29.5 grams = 34.6 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.4	Weight of clean pan	-	0.655
weight of container after oil poured engine	-	1.82	Remove oil filter, weigh used filter	+	1.65
weight of new dry oil filter	+	0.855	Weight of pan & drained oil	+	6.84
Total		9.435 *start*	Total		7.835 *end*

Oil consumption

= *start* - *end* = 1.6 lbs = 725.8 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	11.365	Weight of clean pan	-	0.655
weight of container after oil poured engine	-	2.355	Remove oil filter, weigh used filter	+	1.8
weight of new dry oil filter	+	0.875	Weight of pan & drained oil	+	7.465
Total		9.885 *start*	Total		8.61 *end*

Oil consumption

= *start* - *end* = 1.275 lbs = 578.3 grams

RUN TWO 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.665	Weight of clean pan	-	0.65
weight of container after oil poured engine	-	0.68	Remove oil filter, weigh used filter	+	1.605
weight of new dry oil filter	+	0.86	Weight of pan & drained oil	+	7.16
Total		9.845 *start*	Total		8.115 *end*

Oil consumption

= *start* - *end* = 1.73 lbs = 784.7 gram

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.925	Weight of clean pan		0.65
weight of container after oil poured engine		1.75	Remove oil filter, weigh used filter	+	1.785
weight of new dry oil filter	+	0.855	Weight of pan & drained oil	+	7.39
Total		10.03 *start*	Total		8.525 *end*

Oil consumption

= *start* - *end* = 1.505 lbs = 682.7 grams

DC2 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.985	Weight of clean pan	-	0.675
weight of container after oil poured engine	-	2.105	Remove oil filter, weigh used filter	+	1.65
weight of new dry oil filter	+	0.88	Weight of pan & drained oil	+	8.275
Total		9.76 *start*	Total		9.25 *end*

Oil consumption

= *start* - *end* = 0.51 lbs = 231.3 grams = 271.5 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.895	Weight of clean pan	-	0.65
weight of container after oil poured engine	-	2.075	Remove oil filter, weigh used filter	+	1.61
weight of new dry oil filter	+	0.865	Weight of pan & drained oil	+	6.535
Total		9.685 *start*	Total		7.495 *end*

Oil consumption

= *start* - *end* = 2.19 lbs = 993.4 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.925	Weight of clean pan	-	0.65
weight of container after oil poured engine	-	1.33	Remove oil filter, weigh used filter	+	1.585
weight of new dry oil filter	+	0.87	Weight of pan & drained oil	+	6.48
Total		9.465 *start*	Total		7.415 *end*

Oil consumption

= *start* - *end* = 2.05 lbs = 929.9 grams

RUN TWO 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.32	Weight of clean pan	-	0.68
weight of container after oil poured engine	-	2.2	Remove oil filter, weigh used filter	+	1.66
weight of new dry oil filter	+	0.86	Weight of pan & drained oil	+	5.985
Total		8.98 *start*	Total		6.965 *end*

Oil consumption

= *start* - *end* = 2.015 lbs = 914.0 gram

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.59	Weight of clean pan	-	0.815
weight of container after oil poured engine	-	1.36	Remove oil filter, weigh used filter	+	1.615
weight of new dry oil filter	+	0.86	Weight of pan & drained oil	+	8.14
Total		9.09 *start*	Total		8.94 *end*

Oil consumption

= *start* - *end* = 0.15 lbs = 68.0 grams

* oil add = 4.165-2.465 = 1.7 lbs = 771.1 grams 6/5/00

DC3 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**		
Weight of new test oil/pan	+	12.015	Weight of clean pan	-	0.68
weight of container after oil poured engine	-	3.32	Remove oil filter, weigh used filter	+	1.625
weight of new dry oil filter	+	0.87	Weight of pan & drained oil	+	8.385
Total		9.565 *start*	Total		9.33 *end*

Oil consumption

= *start* - *end* = 0.235 lbs = 106.6 grams = 125.1 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.985	Weight of clean pan	-	0.65
weight of container after oil poured engine	-	1.26	Remove oil filter, weigh used filter	+	1.625
weight of new dry oil filter	+	0.86	Weight of pan & drained oil	+	7.38
Total		9.585 *start*	Total		8.355 *end*

Oil consumption

= *start* - *end* = 1.23 lbs = 557.9 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	11.345	Weight of clean pan	-	0.69
weight of container after oil poured engine	-	2.73	Remove oil filter, weigh used filter	+	1.665
weight of new dry oil filter	+	0.875	Weight of pan & drained oil	+	7.26
Total		9.49 *start*	Total		8.235 *end*

Oil consumption

= *start* - *end* = 1.255 lbs = 569.3 grams

RUN TWO 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.565	Weight of clean pan	-	0.65
weight of container after oil poured engine	-	0.755	Remove oil filter, weigh used filter	+	1.605
weight of new dry oil filter	+	0.865	Weight of pan & drained oil	+	8.23
Total		9.675 *start*	Total		9.185 *end*

Oil consumption

= *start* - *end* = 0.49 lbs = 222.3 gram

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.98	Weight of clean pan		0.69
weight of container after oil poured engine		0.92	Remove oil filter, weigh used filter	+	1.165
weight of new dry oil filter	+	0.865	Weight of pan & drained oil	+	7.895
Total		9.925 *start*	Total		8.37 *end*

Oil consumption

= *start* - *end* = 1.555 lbs = 705.3 grams

DC4 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.015	Weight of clean pan	-	0.655
weight of container after oil poured engine	-	1.285	Remove oil filter, weigh used filter	+	1.605
weight of new dry oil filter	+	0.87	Weight of pan & drained oil	+	8.375
Total		9.6 *start*	Total		9.325 *end*

Oil consumption

= *start* - *end* = 0.275 lbs = 124.7 grams = 146.4 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.865	Weight of clean pan		0.65
weight of container after oil poured engine	-	1.405	Remove oil filter, weigh used filter	+	1.615
weight of new dry oil filter	+	0.87	Weight of pan & drained oil	+	6.88
Total		9.33 *start*	Total		7.845 *end*

Oil consumption

= *start* - *end* = 1.485 lbs = 673.6 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.31	Weight of clean pan		0.645
weight of container after oil poured engine		1.205	Remove oil filter, weigh used filter	+	1.62
weight of new dry oil filter	+	0.865	Weight of pan & drained oil	+	7.48
Total		9.97 *start*	Total		8.455 *end*

Oil consumption

= *start* - *end* = 1.515 lbs = 687.2 grams

RUN TWO 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.675	Weight of clean pan	-	0.675
weight of container after oil poured engine	-	0.905	Remove oil filter, weigh used filter	+	1.635
weight of new dry oil filter	+	0.865	Weight of pan & drained oil	+	6.9
Total		9.635 *start*	Total		7.86 *end*

Oil consumption

= *start* - *end* = 1.775 lbs = 805.1 gram

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.535	Weight of clean pan		0.65
weight of container after oil poured engine		0.86	Remove oil filter, weigh used filter	+	1.62
weight of new dry oil filter	+	0.855	Weight of pan & drained oil	+	7.24
Total		9.53 *start*	Total		8.21 *end*

Oil consumption

= *start* - *end* = 1.32 lbs = 598.8 grams

GP1 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**	
Weight of new test oil/pan	+	9.045	Weight of clean pan	0.67
weight of container after oil poured engine-		0.700	Remove oil filter, weigh used filter	0.935
weight of new dry oil filter	+	0.565	Weight of pan & drianed oil	7.935
Total		8.91 *start*	Total	8.2 *end*

Oil consumption

= *start* - *end* = 0.71 lbs = 322.1 grams = 378.0 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	9.665	Weight of clean pan	0.695
weight of container after oil poured engine-		1.365	Remove oil filter, weigh used filter	0.855
weight of new dry oil filter	+	0.565	Weight of pan & drianed oil	2.97
Total		8.865 *start*	Total	3.13 *end*

Oil consumption

= *start* - *end* = 5.735 lbs = 2601.4 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	10.5	Weight of clean pan	0.65
weight of container after oil poured engine-		2.07	Remove oil filter, weigh used filter	0.715
weight of new dry oil filter	+	0.575	Weight of pan & drianed oil	8.08
Total		9.005 *start*	Total	8.145 *end*

Oil consumption

= *start* - *end* = 0.86 lbs = 390.1 grams

* oil add = 2.385-0.355= 2.03 lbs = 920.8 grams 5-May

* oil add = 2.345-0.345 = 2 lbs = 907.2 grams 9-May

RUN TWO 4,000-mile oil change

Start of Test				**End of Test**		
Weight of new test oil/pan	+	9.88		Weight of clean pan	0.665	
weight of container after oil poured engine-		1.55		Remove oil filter, weigh used filter	0.735	
weight of new dry oil filter	+	0.545		Weight of pan & drianed oil	6.8	
Total		8.875	*start*	Total	6.87	*end*

Oil consumption

= *start* - *end* = 2.005 lbs = 909.5 gram

* oil add = 2.345-0.37= 1.975 lbs = 895.9 grams 24-May
* oil add = 2.32-0.35= 1.97 lbs = 893.6 grams 29-May

RUN TWO 8,000-mile oil change

Start of Test				**End of Test**		
Weight of new test oil/pan	+	10.51		Weight of clean pan	0.645	
weight of container after oil poured engine-		2.54		Remove oil filter, weigh used filter	0.935	
weight of new dry oil filter	+	0.54		Weight of pan & drianed oil	6.025	
Total		8.51	*start*	Total	6.315	*end*

Oil consumption

= *start* - *end* = 2.195 lbs = 995.7 grams

GP2 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**	
Weight of new test oil/pan	+	9.83	Weight of clean pan	0.655
weight of container after oil poured engine-		2.18	Remove oil filter, weigh used filter	1.12
weight of new dry oil filter	+	0.56	Weight of pan & drianed oil	7.31
Total		8.21 *start*	Total	7.775 *end*

Oil consumption

= *start* - *end* = 0.435 lbs = 197.3 grams = 231.6 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	9.85	Weight of clean pan	0.645
weight of container after oil poured engine-		1.79	Remove oil filter, weigh used filter	0.7
weight of new dry oil filter	+	0.57	Weight of pan & drianed oil	6.045
Total		8.63 *start*	Total	6.1 *end*

Oil consumption

= *start* - *end* = 2.53 lbs = 1147.6 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**	
Weight of new test oil/pan	+	9.625	Weight of clean pan	0.68
weight of container after oil poured engine-		2.135	Remove oil filter, weigh used filter	0.74
weight of new dry oil filter	+	0.565	Weight of pan & drianed oil	5.74
Total		8.055 *start*	Total	5.8 *end*

Oil consumption

= *start* - *end* = 2.255 lbs = 1022.9 grams

RUN TWO 4,000-mile oil change

Start of Test				**End of Test**		
Weight of new test oil/pan	+	10.765		Weight of clean pan	0.64	
weight of container after oil poured engine-		2.675		Remove oil filter, weigh used filter	0.735	
weight of new dry oil filter	+	0.535		Weight of pan & drianed oil	6.555	
Total		8.625	*start*	Total	6.65	*end*

Oil consumption

= *start* - *end* = 1.975 lbs = 895.9 gram

RUN TWO 8,000-mile oil change

Start of Test				**End of Test**		
Weight of new test oil/pan	+	10.17		Weight of clean pan	0.655	
weight of container after oil poured engine-		2.165		Remove oil filter, weigh used filter	0.73	
weight of new dry oil filter	+	0.54		Weight of pan & drianed oil	8.155	
Total		8.545	*start*	Total	8.23	*end*

Oil consumption

= *start* - *end* = 0.315 lbs = 142.9 grams = 167.7 ml

* oil add = 2.4-0.365 = 2.035 lbs = 923.1 grams 5-Jun

GP3 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.88	Weight of clean pan	-	0.655
weight of container after oil poured engine	-	1.955	Remove oil filter, weigh used filter	+	0.94
weight of new dry oil filter	+	0.565	Weight of pan & drained oil	+	7.72
Total		8.49 *start*	Total		8.005 *end*

Oil consumption

= *start* - *end* = 0.485 lbs = 220.0 grams = 258.2 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.935	Weight of clean pan		0.69
weight of container after oil poured engine	-	2.235	Remove oil filter, weigh used filter	+	0.72
weight of new dry oil filter	+	0.57	Weight of pan & drained oil	+	6.4
Total		8.27 *start*	Total		6.43 *end*

Oil consumption

= *start* - *end* = 1.84 lbs = 834.6 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.67	Weight of clean pan		0.655
weight of container after oil poured engine		2.755	Remove oil filter, weigh used filter	+	0.695
weight of new dry oil filter	+	0.56	Weight of pan & drained oil	+	6.76
Total		8.475 *start*	Total		6.8 *end*

Oil consumption

= *start* - *end* = 1.675 lbs = 759.8 grams = 891.7 ml

RUN TWO 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.4	Weight of clean pan	-	0.645
weight of container after oil poured engine	-	2.675	Remove oil filter, weigh used filter	+	0.88
weight of new dry oil filter	+	0.535	Weight of pan & drained oil	+	6.125
Total		8.26 *start*	Total		6.36 *end*

Oil consumption

= *start* - *end* = 1.9 lbs = 861.8 grams

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.165	Weight of clean pan		0.655
weight of container after oil poured engine		1.945	Remove oil filter, weigh used filter	+	0.91
weight of new dry oil filter	+	0.54	Weight of pan & drained oil	+	6.605
Total		8.76 *start*	Total		6.86 *end*

Oil consumption

= *start* - *end* = 1.9 lbs = 861.8 grams

GP4 OIL CONSUMPTION

Initial 1,000-mile oil check

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.99	Weight of clean pan	-	0.675
weight of container after oil poured engine	-	2.86	Remove oil filter, weigh used filter	+	0.94
weight of new dry oil filter	+	0.56	Weight of pan & drained oil	+	8.085
Total		8.69 *start*	Total		8.35 *end*

Oil consumption

= *start* - *end* = 0.34 lbs = 154.2 grams = 181.0 ml

RUN ONE 4,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.855	Weight of clean pan		0.805
weight of container after oil poured engine	-	1.795	Remove oil filter, weigh used filter	+	6.565
weight of new dry oil filter	+	0.57	Weight of pan & drained oil	+	0.74
Total		8.63 *start*	Total		6.5 *end*

Oil consumption

= *start* - *end* = 2.13 lbs = 966.2 grams

RUN ONE 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.055	Weight of clean pan		0.805
weight of container after oil poured engine		1.65	Remove oil filter, weigh used filter	+	6.565
weight of new dry oil filter	+	0.565	Weight of pan & drained oil	+	0.74
Total		8.97 *start*	Total		6.5 *end*

Oil consumption

= *start* - *end* = 2.47 lbs = 1120.4 grams

Start of Test			**End of Test**		
Weight of new test oil/pan	+	10.055	Weight of clean pan	-	0.655
weight of container after oil poured engine	-	1.65	Remove oil filter, weigh used filter	+	0.71
weight of new dry oil filter	+	0.565	Weight of pan & drained oil	+	7.1
Total		8.97 *start*	Total		7.155 *end*

Oil consumption

= *start* - *end* = 1.815 lbs = 823.3 gram

RUN TWO 8,000-mile oil change

Start of Test			**End of Test**		
Weight of new test oil/pan	+	9.905	Weight of clean pan	-	0.805
weight of container after oil poured engine	-	1.665	Remove oil filter, weigh used filter	+	0.945
weight of new dry oil filter	+	0.54	Weight of pan & drained oil	+	6.785
Total		8.78 *start*	Total		6.925 *end*

Oil consumption

= *start* - *end* = 1.855 lbs = 841.4 grams

APPENDIX B

FUEL ANALYSIS RESULTS

Fuel Analysis at the Beginning of Test

FUEL CODE	BASE FUEL GA-3931	REFERENCE FUEL GB-3949	TEST FUEL GB-3942
ADDITIVE CODE	N/A	Vektron 2864	Vektron 6913
Unwashed/Washed Gum, ASTM D-381	0.0/0.0	26.0/1.0	27.0/0.0
Oxidation Stability ASTM D-525	NO BREAK	NO BREAK	NO BREAK
Sulfur by XRF ASTM D-2622	0.028	0.0021	0.0021
Lead, ASTM D-3237	<0.001	0.001	<0.001
Relative Density, ASTM D-4052			
Specific Gravity	0.7523	0.7564	0.7570
API	56.6	55.6	55.4
RVP, ASTM D-5191	7.53	6.45	6.38
Distillation, ASTM-D86			
IBP	108	107	111
5	139	143	144
10	150	154	155
15	159	163	164
20	167	172	171
30	183	186	185
40	198	199	198
50	210	211	209
60	223	223	221
70	243	241	239
80	283	279	278
90	341	339	339
95	359	355	354
FBP	396	383	380
Recovery, %	99.0	99.0	99.5
Residue, %	0.5	0.5	0.5
Loss, %	0.5	0.5	0
FIA, vol%, ASTM D-1319			
Aromatics	25.7	29.1	29.9
Olefins	6.8	8.2	7.4
Saturates	67.5	62.7	62.7
Oxygenates, wt% ASTM D-4815			
MeOH	0	0	0
TBA	0	0	0
MTBE	0	0	0
IBA	0	0	0
Benzene	0.61	0.66	0.66

Fuel Analysis at the End of Test

FUEL CODE	BASE FUEL GA-3931	REFERENCE FUEL GB-3949	TEST FUEL GB-3942
ADDITIVE CODE	N/A	Vektron 2864	Vektron 6913
Unwashed/Washed Gum, ASTM D-381	1.0/0.0	29.0/0.0	26.0/0.0
Oxidation Stability ASTM D-525	NO BREAK	NO BREAK	NO BREAK
Sulfur by XRF ASTM D-2622	0.0019	0.0048	0.002
Lead, ASTM D-3237	<0.002	<0.002	<0.002
Relative Density, ASTM D-4052			
Specific Gravity	0.7512	0.7489	0.7561
API	56.9	57.4	55.6
RVP, ASTM D-5191	7.38	6.34	6.22
Distillation, ASTM-D86			
IBP	102	106	110
5	132	141	145
10	145	153	156
15	154	161	164
20	163	169	172
30	179	183	186
40	193	196	198
50	206	208	209
60	219	221	221
70	236	240	240
80	275	276	280
90	332	338	340
95	355	355	357
FBP	379	382	379
Recovery, %	98.0	98.5	99.0
Residue, %	0.5	0.5	0.5
Loss, %	1.0	1.0	0.5
FIA, vol%, ASTM D-1319			
Aromatics	25.9	23.5	27.0
Olefins	8.2	7.4	8.0
Saturates	65.9	69.1	64.0
Oxygenates, wt% ASTM D-4815			
Benzene	0.65	0.36	0.67
TAME (vol %)	0.17	0.18	0.17
TAME (wt %)	0.18	0.19	0.18

APPENDIX C

TEST VEHICLE MAINTENANCE REPORT

Maintenance Status Report

EX1

Date	Odometer Miles	Action
2/20/00	23,711	1,000 mile oil change
3/12/00	27,912	4,000 mile oil change, RUN1
3/22/00	31,912	8,000 mile oil change, RUN1
4/6/00	36,053	4,000 mile oil change, RUN2
4/16/00	40,053	8,000 mile oil change, RUN2

Maintenance Status Report

EX2

Date	Odometer Miles	Action
2/20/00	25,200	1,000 mile oil change
3/13/00	29,362	4,000 mile oil change, RUN1
3/22/00	33,361	8,000 mile oil change, RUN1
4/7/00	37,502	4,000 mile oil change, RUN2
4/18/00	41,502	8,000 mile oil change, RUN2

Maintenance Status Report

EX3

Date	Odometer Miles	Action
2/20/00	22,077	1,000 mile oil change
3/15/00	26,336	4,000 mile oil change, RUN1
3/24/00	30,336	8,000 mile oil change, RUN1
4/8/00	34,477	4,000 mile oil change, RUN2
4/20/00	38,477	8,000 mile oil change, RUN2

Maintenance Status Report

EX4

Date	Odometer Miles	Action
2/20/00	24,293	1,000 mile oil change
3/13/00	27,744	mis-fueling during RUN1 test. Re-conduct initial emission test and RUN1 test.
4/8/00	33,607	4,000 mile oil change, RUN1
4/21/00	37,607	8,000 mile oil change, RUN1
4/24/00		replaced idle air control valve and EGR valve
5/7/00	41,804	4,000 mile oil change, RUN2
5/16/00	45,804	8,000 mile oil change, RUN2

Maintenance Status Report

GC1

Date	Odometer Miles	Action
3/8/00	25,576	1,000 mile oil change
3/25/00		repaired rear main seal leak (1 3/4 qt low)
3/27/00	29,771	4,000 mile oil change, RUN1
4/5/00	33,771	8,000 mile oil change, RUN1
4/20/00	37,914	4,000 mile oil change, RUN2
5/1/00	41,915	8,000 mile oil change, RUN2

Maintenance Status Report

GC2

Date	Odometer Miles	Action
3/8/00	58,213	1,000 mile oil change
3/26/00	62,327	4,000 mile oil change, RUN1
4/7/00	66,327	8,000 mile oil change, RUN1
4/21/00	70,451	4,000 mile oil change, RUN2
5/1/00	74,451	8,000 mile oil change, RUN2

Maintenance Status Report

GC3

Date	Odometer Miles	Action
3/8/00	26,797	1,000 mile oil change
4/1/00	30,960	4,000 mile oil change, RUN1
4/10/00	34,960	8,000 mile oil change, RUN1
4/27/00	39,083	4,000 mile oil change, RUN2
5/6/00	43,083	8,000 mile oil change, RUN2

Maintenance Status Report

GC4

Date	Odometer Miles	Action
4/13/00		flat tire fixed (right front)
4/24/00	34,281	1,000 mile oil change
4/27/00	35,282	1,000 mile oil change (second oil change)
5/10/00	39,448	4,000 mile oil change, RUN1
5/21/00	43,448	8,000 mile oil change, RUN1
6/4/00	47,612	4,000 mile oil change, RUN2
6/13/00	51,611	8,000 mile oil change, RUN2

Maintenance Status Report

HA1

Date	Odometer Miles	Action
3/2/00	30,531	1,000 mile oil change
3/24/00	34,959	4,000 mile oil change, RUN1
4/3/00	38,959	8,000 mile oil change, RUN1
4/19/00	43,108	4,000 mile oil change, RUN2
4/28/00	47,107	8,000 mile oil change, RUN2

Maintenance Status Report

HA2

Date	Odometer Miles	Action
3/2/00	26,912	1,000 mile oil change
3/23/00	31,216	4,000 mile oil change, RUN1
4/2/00	35,217	8,000 mile oil change, RUN1
4/17/00	39,612	4,000 mile oil change, RUN2
4/26/00	43,345	8,000 mile oil change, RUN2

Maintenance Status Report

HA3

Date	Odometer Miles	Action
4/10/00	19,207	1,000 mile oil change
4/25/00	23,383	4,000 mile oil change, RUN1
5/4/00	27,383	8,000 mile oil change, RUN1
5/18/00	31,528	4,000 mile oil change, RUN2
5/27/00	35,528	8,000 mile oil change, RUN2

Maintenance Status Report

HA4

Date	Odometer Miles	Action
5/1/00	27,102	1,000 mile oil change
5/15/00	31,245	4,000 mile oil change, RUN1
5/24/00	35,245	8,000 mile oil change, RUN1
6/8/00	39,408	4,000 mile oil change, RUN2
6/17/00	43,408	8,000 mile oil change, RUN2

Maintenance Status Report

FF1

Date	Odometer Miles	Action
2/18/00	39,767	1,000 mile oil change
2/20/00	40,767	1,000 mile oil change (second oil change)
3/13/00	44,967	4,000 mile oil change, RUN1
3/22/00	48,967	8,000 mile oil change, RUN1
4/6/00	53,127	4,000 mile oil change, RUN2
4/16/00	57,126	8,000 mile oil change, RUN2

Maintenance Status Report

FF2

Date	Odometer Miles	Action
2/20/00	43,187	1,000 mile oil change
3/14/00	47,428	4,000 mile oil change, RUN1
3/23/00	51,429	8,000 mile oil change, RUN1
4/6/00	55,589	4,000 mile oil change, RUN2
4/17/00	59,589	8,000 mile oil change, RUN2

Maintenance Status Report

FF3

Date	Odometer Miles	Action
3/16/00	61,513	1,000 mile oil change
4/4/00	65,682	4,000 mile oil change, RUN1
4/14/00	69,683	8,000 mile oil change, RUN1
4/28/00	73,840	4,000 mile oil change, RUN2
5/7/00	77,840	8,000 mile oil change, RUN2

Maintenance Status Report

FF4

Date	Odometer Miles	Action
4/10/00	59,044	1,000 mile oil change
4/28/00	63,203	4,000 mile oil change, RUN1
5/6/00		adjusted parameters of fuel level signal
5/8/00	67,204	8,000 mile oil change, RUN1
5/22/00	71,347	4,000 mile oil change, RUN2
5/31/00	75,347	8,000 mile oil change, RUN2

Maintenance Status Report

FE1

Date	Odometer Miles	Action
3/24/00	65,303	1,000 mile oil change
4/18/00	69,529	4,000 mile oil change, RUN1
4/28/00	73,529	8,000 mile oil change, RUN1
5/12/00	77,655	4,000 mile oil change, RUN2
5/22/00	81,655	8,000 mile oil change, RUN2

Maintenance Status Report

FE2

Date	Odometer Miles	Action
4/6/00	73,254	1,000 mile oil change
4/15/00		changed out heater core, replaced radiator and checked pressure system
4/24/00	77,382	4,000 mile oil change, RUN1
5/4/00	81,383	8,000 mile oil change, RUN1
5/17/00	85,650	4,000 mile oil change, RUN2
5/28/00	89,649	8,000 mile oil change, RUN2

Maintenance Status Report

FE3

Date	Odometer Miles	Action
4/17/00	64,782	after 1,000 mile oil change
4/17/00	64,802	speed signal generator replaced
4/20/00	65,818	1,000 mi. oil change
5/3/00	67,446	1,000 mi. oil change
5/17/00	71,570	4,000 mi. oil change
5/22/00		Abort the test due to emission catalyst problem

Maintenance Status Report

FE4

Date	Odometer Miles	Action
4/28/00	80,496	1,000 mile oil change
5/8/00		replaced cooling fan relay
5/19/00	84,638	4,000 mile oil change, RUN1
5/24/00		replaced timing belt
5/29/00	88,631	8,000 mile oil change, RUN1
6/12/00	92,755	4,000 mile oil change, RUN2
6/21/00	96,755	8,000 mile oil change, RUN2

Maintenance Status Report

FE5

Date	Odometer Miles	Action
5/22/00	71,724	1,000 mile oil change
6/4/00	75,994	4,000 mile oil change, RUN1
6/12/00	79,891	8,000 mile oil change, RUN1
6/23/00	84,157	4,000 mile oil change, RUN2
7/5/00	88,020	8,000 mile oil change, RUN2

Maintenance Status Report

DC1

Date	Odometer Miles	Action
3/12/00	76,215	1,000 mile oil change
4/6/00	80,431	4,000 mile oil change, RUN1
4/16/00	84,432	8,000 mile oil change, RUN1
5/1/00	88,563	4,000 mile oil change, RUN2
5/6/00		added trans fluid
5/10/00	92,604	8,000 mile oil change, RUN2

Maintenance Status Report

DC2

Date	Odometer Miles	Action
4/17/00	97,792	after 1,000 mile
4/29/00		replaced bypass hose and added engine coolant
5/4/00	101,934	4,000 mile oil change, RUN1
5/6/00		added transmission fluid
5/13/00	105,933	8,000 mile oil change, RUN1
5/23/00		added 1 qt. transmission fluid
5/25/00		added 1 gal. transmission fluid, replaced front pump seals, torque converter seals and half shaft seals
5/31/00	110,125	4,000 mile oil change, RUN2
6/5/00		added oil
6/9/00	114,125	8,000 mile oil change, RUN2

Maintenance Status Report

DC3

Date	Odometer Miles	Action
5/2/00	106,646	1,000 mile oil change
5/15/00	110,770	4,000 mile oil change, RUN1
5/17/00		replaced broken cv shaft
5/23/00	114,771	8,000 mile oil change, RUN1
6/5/00	118,892	4,000 mile oil change, RUN2
6/12/00	122,892	8,000 mile oil change, RUN2

Maintenance Status Report

DC4

Date	Odometer Miles	Action
4/24/00	82,132	1,000 mile oil change
5/9/00	86,265	4,000 mile oil change, RUN1
5/19/00	90,265	8,000 mile oil change, RUN1
6/1/00	94,429	4,000 mile oil change, RUN2
6/10/00	98,429	8,000 mile oil change, RUN2

Maintenance Status Report

GP1

Date	Odometer Miles	Action
4/13/00	91,202	1,000 mile oil change
5/4/00	95,390	4,000 mile oil change, RUN1
5/8/00		1 qt oil added
5/13/00	99,390	8,000 mile oil change, RUN1
5/29/00		1 qt oil added
5/30/00	103,572	4,000 mile oil change, RUN2
5/31/00		repaired trans fluid leak
6/9/00	107,572	8,000 mile oil change, RUN2

Maintenance Status Report

GP2

Date	Odometer Miles	Action
4/20/00	48,220	1,000 mile oil change
5/6/00	52,360	4,000 mile oil change, RUN1
5/15/00	56,360	8,000 mile oil change, RUN1
5/28/00	60,501	4,000 mile oil change, RUN2
6/5/00		1 qt oil added
6/6/00	64,501	8,000 mile oil change, RUN2

Maintenance Status Report

GP3

Date	Odometer Miles	Action
4/20/00	63,589	1,000 mile oil change
5/5/00	67,709	4,000 mile oil change, RUN1
5/13/00	71,709	8,000 mile oil change, RUN1
5/28/00	75,913	4,000 mile oil change, RUN2
6/5/00	79,914	8,000 mile oil change, RUN2

Maintenance Status Report

GP4

Date	Odometer Miles	Action
4/24/00	67,450	1,000 mile oil change
5/5/00	71,615	4,000 mile oil change, RUN1
5/15/00	75,615	8,000 mile oil change, RUN1
5/29/00	79,751	4,000 mile oil change, RUN2
6/6/00	83,751	8,000 mile oil change, RUN2

Maintenance Status Report

GP4

Date	Odometer Miles	Action
4/24/00	67,450	1,000 mile oil change
5/5/00	71,615	4,000 mile oil change, RUN1
5/15/00	75,615	8,000 mile oil change, RUN1
5/29/00	79,751	4,000 mile oil change, RUN2
6/6/00	83,751	8,000 mile oil change, RUN2